

Accessories

Clutch

**Propshaft** 

**Electrical** 

N

E

X

Cab

**Steering** 

**Axle** 

**Brakes** 

**Wheels** 

**Frame** 

**Aircon** 

**Fuel** 

Cooling



## Workshop Manual

**Engine** 

F Suspension

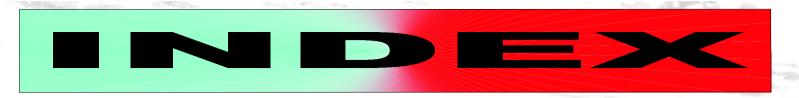
R Suspension

**Gearbox - MSG** 

Hi - Tech

Gearbox - MUA

Eng. Electrical



General Information Maintenance and Lubrication

Heating and Airconditioning

Frame and Bumper Sheetmetal

**Body Electrical** 

Front Alignment
Steering (Manual&Power)
Front Suspension
Rear Suspension
Wheels and Tyres

**Engine - Diesel** 

Diagnosis

Mechanical

Cooling

Fuel

Electrical

Exhaust

**Engine - Petrol** 

Diagnosis

Mechanical

Cooling

**Fuel** 

Electrical

**Exhaust** 

**Transmission** 

MUA

MSG

Clutch

Accessories

Cab

Axle

Propshaft

Rear Axle

Diff Lock

# ISUZU KB-SERIES

## **WORKSHOP MANUAL**

**SECTION OA** 

GENERAL INFORMATION

## SECTION 0A GENERAL INFORMATION

#### **TABLE OF CONTENTS**

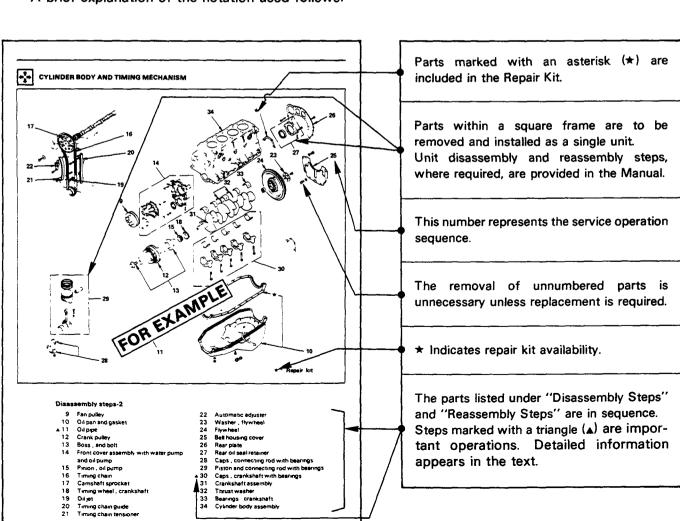
	PAG	ìΕ
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Identification	. OA-	6
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#### **GENERAL REPAIR INSTRUCTIONS**

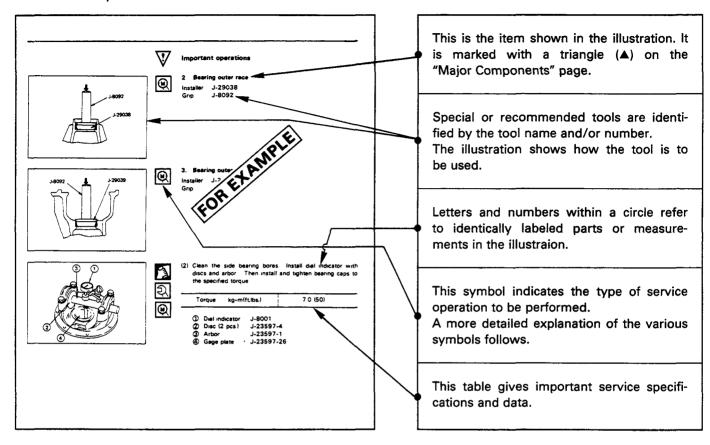
- 1. Park the vehicle on level ground and chock the front or rear wheels before lifting the vehicle.
- 2. Raise the vehicle with a jack set against the axle or the frame.
- 3. Support the vehicle on chassis stands.
- 4. Use covers on the vehicle body, seats, and floor to prevent damage and/or contamination.
- 5. Disconnect the grounding cable from the battery before performing service operations.
  - This will prevent cable damage or burning due to shortcircuiting.
- Handle brake fluid and antifreeze solution with great care.
   Spilling these liquids on painted surfaces will damage the paint.
- 7. The use of the proper tool(s) and special tools where specified is essential to efficient, reliable, and safe service operations.
- 8. Always use genuine ISUZU replacement parts.
- Discard used cotter pins, gaskets, O-rings, oil seals, lock washers, and self-locking nuts at disassembly.
   Normal function of these parts cannot be guaranteed if they are reused.
- 10. Prepare new cotter pins, gaskets, O-rings, oil seals, lock washers, and self-locking nuts for installation.
- 11. Keep the disassembled parts neatly in groups.
  - This will facilitate smooth and correct reassembly.
- 12. Keep fixing nuts and bolts separate.
  - Fixing nuts and bolts vary in hardness and design according to installation position.
- 13. Clean all parts before inspection or reassembly.
- 14. Clean the oil ports and other openings with compressed air to make certain that they are free from dirt and obstructions.
- 15. Lubricate the rotating and sliding faces of all moving parts with oil or grease before installation.
- 16. Use the recommended liquid gasket to prevent leakage.
- 17. Carefully observe all nut and bolt torque specifications.
- 18. When removing or replacing parts that require refrigerant to the discharged Air conditioning system, be sure to use the Vehicle Refrigerant Recovery and Recycling Equipment (VRRRE) to recover and recycle Refrigerant-12, to promote the movement for the protection of the ozone layer covering the earth.
- 19. Check and recheck your work. No service operation is completed until you have done this.

#### NOTES ON THE FORMAT OF THIS MANUAL

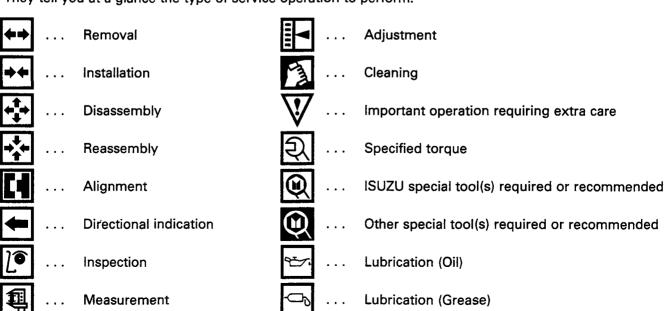
- 1. Find the applicable Section by referring to the index at the front of the Workshop Manual binder.
- 2. The following technical service information is included in this Section:
  - Identification
  - Maintenance schedules
  - Recommended lubricants
  - Recommended fuels
  - Oil viscosity charts
- 3. Individual Sections of this Workshop Manual are divided into the following categories:
  - Main data and specifications
  - Torque specifications
  - Recommended liquid gasket
  - Loctite application procedure
  - Servicing
  - Removal and installation
  - Disassembly
  - Inspection and repair
  - Reassembly
  - Troubleshooting
- 4. Each "Major Components" page of this Workshop Manual has an exploded view of the applicable area A brief explanation of the notation used follows:



5. Below is a sample of the Workshop Manual text following the "Major Components" page. A brief explanation of the notation used follows:



6. The following symbols appear throughout the Workshop Manual. They tell you at a glance the type of service operation to perform.



Liquid gasket application

- 7. Measurement criteria are defined by the terms "standard" and "limit".
  - A measurement falling within the "standard" range indicates that the applicable part or parts are serviceable.
  - "Limit" is an absolute value.
  - A measurement falling outside the "limit" indicates that the applicable part or parts must be repaired or replaced.
- 8. Components and parts are listed in the singular form throughout the Workshop Manual.
- 9. The following directional criteria are used throughout the Workshop Manual:

Front:
The cooling fan side of the engine.

ie cooling fan side of the engine

Right:

The right-hand side of the engine viewed from the flywheel.

Left:

The left-hand side of the engine viewed from the flywheel.

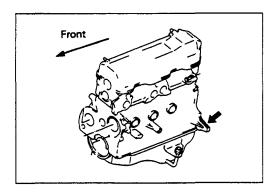
Rear:

The flywheel side of the engine.

Cylinder numbers are counted from the front of the engine towards the rear.

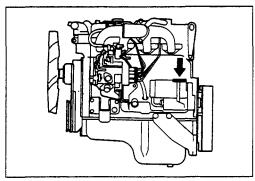
The engine's rotation is clockwise viewed from the front of the engine.

#### IDENTIFICATION



### ENGINE NUMBER (PETROL ENGINE, 4Z SERIES)

The engine number stamped on the rear left-hand side of the cylinder body.



### ENGINE NUMBER (DIESEL ENGINE, 4J & C SERIES)

The engine number is stamped on the rear left-hand side of the cylinder body.

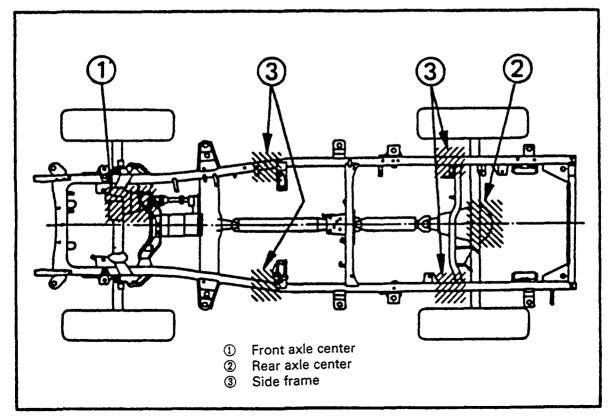
#### **VEHICLE IDENTIFICATION PLATE**

The vehicle identification plate is attached to the left hand firewall upper in the engine compartment.

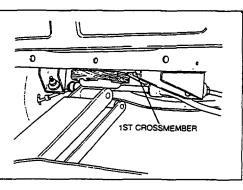
#### LIFTING INSTRUCTIONS

If a lifting device other than the original jack is used, it is most important that the device be applied only to the correct lifting points. (See the illustration.) Raising the vehicle from any other point may result in serious damage.

#### **Lifting Points and Supportable Point-Locations**



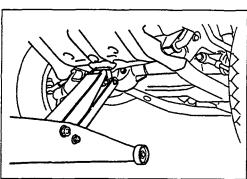
#### **0A-8 GENERAL INFORMATION**



#### LIFTING POINT; FRONT

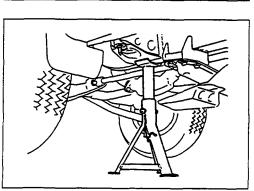
#### 4×2 model

When using floor jack, lift on the center of the 1st crosmember.



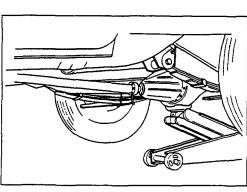
#### 4×4 model

When using floor jack, lift on the center of the skid plate.



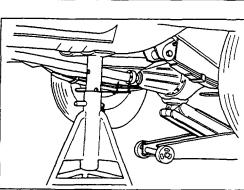
#### SUPPORTABLE POINT; FRONT

 Position the chassis stands at the bottom of the frame sidemember, backward of front wheel.



#### LIFTING POINT; REAR

Position the floor jack at the center of the rear axle case when lifting the vehicle.



#### SUPPORTABLE POINT; REAR

 Position the chassis stands at the bottom of the frame sidemember, forward of the rear wheel.

#### **CONVERSION TABLE**

#### TABLE OF CONTENTS

	PA	AGE
ength	0A	<b>–</b> 9
Area	0A	-11
/olume	0A	-11
Mass	0A	-13
Pressure	0A	<b>—14</b>
Forque	0A	-15
Gemperature	0A	-16

#### **LENGTH**

#### **MILLIMETERS TO INCHES**

#### mm mm mm mm in 1 0.0394 26 1.0236 2.9921 51 2.0079 76 2 0.0787 1.0630 2.0472 3.0315 27 3 0.1181 28 1 1024 53 20866 78 3.0709 0 1575 1.1417 29 3.1102 2.1260 79 54 0.1969 30 1.1811 55 2.1654 80 3,1496 6 0.2362 31 1,2205 2.2047 3.1890 7 82 0.2756 32 1.2598 57 2.2441 3.2283 8 03150 33 1,2992 58 2.2835 83 3.2677 9 0.3543 34 1.3386 2.3228 3.3071 59 35 10 0.3937 1.3780 60 2.3622 85 3.3465 11 0.4331 36 1.4173 3.3858 61 2.4016 86 0.4724 12 37 1.4567 62 2.4409 87 3.4252 13 0.5118 38 1 4961 2.4803 3.4646 63 14 0.5512 39 3.5039 1.5354 64 2.5197 89 0.5906 15 40 1.5748 65 2.5591 90 3,5433 16 0.6299 41 1.6142 3.5827 66 2.5984 17 0.6693 42 1.6535 67 2.6378 92 3.6220 18 0.7087 43 16929 93 3 66 14 68 2.6772 19 0.7480 44 1 7323 27165 94 3.7008 69 20 0.7874 45 17717 70 2 7559 95 3.7402 21 0.8268 46 1.8110 3 7 7 9 5 71 2.7953 96 22 0.8661 47 1.8504 72 97 3.8189 2.8346 23 0.9055 48 1.8898 73 2.8740 98 3.8583 0.9449 24 49 19291 74 2.9134 99 3.8976 25 0 9843 50 1.9685 75 2.9528 100 3 9370 111 101 3.9764 4.3701 121 4.7638 131 5 1575 102 4.0157 112 4.4094 122 4.8031 132 5.1968 103 4.0551 113 4.4488 4.8425 123 133 5.2362 4.0945 104 114 4.4882 124 4.8819 134 5.2756 105 4.1339 4.5276 115 125 4.9213 5.3150 135 106 4.1732 116 4.5669 126 4.9606 136 5.3543

107

108

109

4.2126

4 2520

4.2913

117

118

119

4.6063

4 6457

4.6850

127

128

129

5.0000

5.0394

5 0787

137

138

139

5 3937

5 4331

5.4724

#### **INCHES TO MILLIMETERS**

ın	mm	in.	mm
1/64	0 3969	33/64	13.0969
1/32	0 7938	17/32	13.4938
3/64	1.1906	35/64	13.8906
1/16	1 5875	9/16	14.2875
5/64	1.9844	37/64	14.6844
3/32	2.3813	19/32	15.0813
7/64	2.7781	39/64	15 4781
1/8	3 1 7 5 0	5/8	15 8750
9/64	3.5719	41/64	16 2719
5/32	3.9688	21/32	16.6688
11/64	4 3656	43/64	17.0656
3/16	4 7625	11/16	17.4625
13/64	5.1594	45/64	17.8594
7/32	5.5563	23/32	18.2563
15/64	5.9531	47/64	18 6531
1/4	6 3500	3/4	19 0500
17/64	6.7469	49/64	19 4469
9/32	7.1438	25/32	19.8438
19/64	7 5 4 0 6	51/64	20.2406
5/16	7.9375	13/16	20.6375
21/64	8.3344	53/64	21 0344
11/32	8.7313	27/32	21.4313
23/64	9 1 2 8 1	55/64	21.8281
3/8	9.5250	7/8	22 2250
25/64	9.9219	57/64	22.6219
13/32	10.3188	29/32	23.0188
27/64	10.7156	59/64	23.4156
7/16	11.1125	15/16	23 8125
29/64	11.5094	61/64	24 2094
15/32	11.9063	31/32	24 6063
31/64	12 3031	63/64	25 0031
1/2	12 7000	1	25.4000

1

m

1

ft.

km

1.609

17.703

33.796

49.890

65.983

82.077

98.170

114.263

1

50.331

56.545

62.758

3.2808

0

m

0

ft.

0

km

16.093

32.187

48.280

64.374

80.467

96.561

112.654

0

49.711

55.923

62.137

ft.

m

miles

10

20

30

40

50

60

70

km

80

90

100

2

m

2

ft.

2

km

3.219

19.312

35.406

51,499

67.592

83.686

99.779

115.873

2

50.952

57.166

63.380

6.5617

3

m

3

ft.

3

km

4.828

20.921

37.015

53.108

69.202

85.295

101.389

117.482

3

51.574

57.187

64.001

9.8425

#### LENGTH

#### **FEET TO METERS**

4

m

5

m

7

m

7

ft.

22.9659

7

km

11.265

27.359

43.452

59.546

75.639

91.733

107.826

123.919

140.013

156.106

172.200

7

miles

54.059

60.273

66.487

6

m

6

ft.

19.6850

km

9.656

25.750

41.843

57.936

74.030

90.123

106.217

122.310

6

53.438

59.652

65.865

8

m

8

ft.

26.2467

8

km

12.875

28.968

45.062

61.155

77,249

93.342

109.435

125.529

141.622

157.716

173.809

8

miles

54.681

60.894

67.108

9

m

ft.

9

km 14.484

30.578

46.671

62.764

78.858

94.951

111.045

127.138

143.232

159.325

175.418

9

miles

55.302

61.516

67.729

29.5276

ft.

m

miles

10

20

30

40

50

60

70

80

90

100

km

80

90

100

_		0.305	0.610	0.914	1.219	1.524	1.829	2.134	2.438	2.743	_
10	3.048	3.353	3.658	3.962	4.267	4.572	4.877	5.182	5.486	5.791	10
20	6.096	6.401	6.706	7.010	7.315	7.620	7.925	8.230	8.534	8.839	20
30	9.144	9.449	9.754	10.058	10.363	10.668	10.973	11.278	11.582	11.887	30
40	12.192	12.497	12.802	13.106	13.411	13.716	14.021	14.326	14.630	14.935	40
50	15.240	15.545	15.850	16.154	16.459	16.764	17.069	17.374	17.678	17.983	50
60	18.288	18.593	18.898	19.202	19,507	19.812	20.117	20.422	20.726	21.031	60_
70	21.336	21.641	21.946	22.250	22.555	22.860	23.165	23.470	23 774	24.079	70
80	24.384	24.689	24.994	25.298	25.603	25.908	26.213	26.518	26.822	27.127	80
90	27.432	27.737	28.042	28.346	28.651	28.956	29.261	29.566	29.870	30.175	90
100	30 480	30.785	31.090	31.394	31.699	32.004	32.309	32.614	32.918	33.223	100
	1		1			L	<u> </u>	<u> </u>			

#### 4 5 ft. ft.

16.4042

13.1234

**METERS TO FEET** 

10	32.8084	36.0892	39.3701	42.6509	45.9318	49.2126	52.4934	55.7743	59.0551	62.3360	10
20	65.6168	68.8976	72.1785	75.4593	78.7402	82.0210	85.3018	88.5827	91.8635	95.1444	20
30	98.4252	101.7060	104.9869	108.2677	111.5486	114.8294	118.1102	121.3911	124.6719	127.9528	30
40	131.2336	134.5144	137.7953	141.0761	144.3570	147.6378	150.9186	154.1995	175.4803	160.7612	40
50	164.0420	167.3228	170.6037	173.8845	177.1654	180.4462	183.7270	187.0079	190.2887	193.5696	50
60	196.8504	200.1312	203.4121	206.6929	209.9738	213.2546	216.5354	219.8163	223.0971	226.3780	60
70	229.6588	232.9396	236.2205	239.5013	242.7822	246.0630	249 3438	252.6247	255.9055	259.1864	70
80	262.4672	265.7480	269.0289	272.3097	275.5906	278.8714	282.1522	285.4331	288.7139	291.9948	80
90	295.2756	298.5564	301.8373	305.1181	308.3990	311.6798	314.9606	318.2415	321.5223	324.8032	90
100	328.0840	331.3648	334.6457	337.9265	341.2074	344.4882	347.7690	351.0499	354.3307	357.6116	100

#### 4 5

km

8.047

24.140

40.234

56.327

72,420

88.514

104.607

120,700

km

6.437

22.531

38.624

54.718

70.811

86.905

103.000

119.091

**MILES TO KILOMETERS** 

				133.576 149.669			
100	160.934	162.544	164.153	165.762	167.372	168.981	170.590
•							

#### KILOMETERS TO MILES 5 4

	miles	miles	miles	miles	miles	miles	miles
_		0.621	1.243	1.864	2.485	3.107	3.728
10	6.214	6.835	7.456	8.078	8.699	9.321	9.942
20	12 427	12 040	12670	14202	14012	15 524	16166

_	1	0.621	1.243	1.864	2.485	3.107	3.728	4.350	4.971	5.592	_
10	6.214	6.835	7.456	8.078	8.699	9.321	9.942	10.563	11.185	11.806	10
20	12.427	13.049	13.670	14.292	14.913	15.534	16.156	16.777	17.398	18.020	20
_30	18.641	19.262	19.884	20.505	21.127	_21.748	22.370	22.990	23.612	24.233	30
40	24.855	25.476	26.098	26.719	27.340	27.962	28.583	29.204	29.826	30.447	40
50	31.065	31.690	32.311	32.933	33.554	34.175	34.797	35.418	36.039	36.661	50
60	37.282	37.904	38.525	39.146	39.768	40.389	41.010	41.632	42.253	42.875	60
70	43.496	44.117	44.739	45.360	45.981	46.603	47.224	47.845	48.467	49.088	70

52.816

59.030

65.244

52.195

58.409

64.622

8

cm<sup>2</sup>

116 129

180.645

245.161

309.677

374.193

438.709

503.225

567,741

632.257

696,773

8

in<sup>2</sup>

1.240

2.790

4.340

5.890

7.440

8.990

10.540

12.090

13.640

15.190

16.740

8

cm³(cc)

131.097

294.967

458.838

622.708

786.579

950.450

1114.320

1278.191

1442.062

1605.932

1769.803

in<sup>3</sup>

0.4882

1.0984

1.7086

2.1389

2.9291

3.5393

4.1496

4.7598

5.3700

5.9803

6.5905

51.613

174,193

238.709

303.225

367.741

432.257

496 773

561.289

625.805

690.312

7

ın²

1.085

2.635

4.185

5.735

7.285

8.835

10.385

11.935

13.485

15.035

16.583

7

cm³(cc)

114.709

278.580

442.451

606.321

770,192

934.063

1097.933

1261.804

1425.675

1589 545

1753.416

in<sup>3</sup>

0.4272

1.0374

1.6476

2.2579

2.8681

3.4783

4.0885

4.6988

5.3090

5.9192

6.5295

167.742

232.258

296.774

361.290

425.806

490.322

554.838

619 354

683.870

in<sup>2</sup>

0.930

2.480

4.030

5.580

7.130

8.680

10.230

11.780

13.330

14.880

16.430

6

cm³(cc)

98.322

262.193

426.064

589.934

753.805

917.676

1081.546

1245.417

1409.288

1573.158

1737.029

 $in^3$ 

0.3661

0.9764

1.5866

2.1968

2.8071

3.4173

4.0275

4.6377

5.2480

5.8582

6.4684

9

cm<sup>2</sup>

58.064

122.580

187.096

251.612

316.128

380.644

445.160

509.676

574.192

638.708

703.224

9

in²

1.395

2.945

4.495

6.045

7.595

9.145

10.695

12.245

13.795

15 345

16.895

9

cm³(cc)

147.484

311.354

475.225

639.095

802.966

966.837 1130.707

1294.578

1458.449

1622.319

1786.190

in<sup>3</sup>

0.5492

1.1594

17697

2.3799

2.9901

3.6004

4.2106

4.8208

5.4310

6.0413

6.6515

 $in^2$ 

10

20

30

40

50

60

70

80

90

100

cm<sup>2</sup>

10

20

30 40

50

60

70

80

90

100

 $in^3$ 

10

20

30

40

50

60

70

80

90

100

cm³(cc)

10

20

30

40

50

60

70

80

90

100

#### AREA

ın²	0	1	2	3	4	5	6	7
	cm <sup>2</sup>	cm <sup>2</sup>	cm <sup>2</sup>	cm²	cm²	cm²	cm²	cm²
_		6.452	12.903	19 355	25.806	32.258	38.710	45.161
10	64.516	70.968	77.419	83.871	90.322	96.774	103.226	109.677

141.935

206.451

270.967

335.483

399.999

464.515

529.031

593.547

658.063

2

 $in^2$ 

0.310

1.860

3.410

4.960

6.510

8.060

9.610

11.160

12.710

14.260

15.810

2

cm3(cc)

32.774

196.645

360.515

524.386

688.257

852.127

1015.998

1343.739

1507.610

1671 481

2

in<sup>3</sup>

0.1220

0.7323

1.3425

1.9527

2.5630

3.1732

3.7834

4,3937

5.0039

5.6141

6.2243

135.484

200.000

264.516

329.032

393.548

458.064

522.580

587.096

651,612

1

 $in^2$ 

0.155

1.705

3.255

4.805

6.355

7.905

9.455

11.005

12.555

14.105

15.655

1

cm3(cc)

16.387

180.258

344.128

507.999

671.870

835.740

999.611

1327.352

1491.223

1655.093

1

in<sup>3</sup>

0.0610

0.6713

1.2815

1.8917

2.5020

3.1122

3.7224

4.3326

4.9429

5.5531

6.1633

1163.482 1179.869

20

30

40

50

60

70

80

90

100

cm<sup>2</sup>

10

20

30

40

50

60

70

80

90

100

in³

10

20

30

40

50

60

70

80

90

100

cm3(cc)

10

20

30

40

50

60

70

80

90

100

129.032

193.548

258.064

322.580

387.096

451.612

516.128

580.644

645,160

0

in<sup>2</sup>

1.550

3.100

4.650

6.200

7.750

9.300

10.850

12.400

13.950

15.500

0

cm3(cc)

163.871

327.741

491.612

655.483

819.353

983.224

1147.094

1310.965

1474.836

1638.706

0

in<sup>3</sup>

0.6102

1.2205

1.8307

2.4409

3.0512

3.6614

4.2716

4.8818

5.4921

6.1023

3	4	5	6	7

154.838

219.354

283.870

348.386

412.902

477,418

541.934

606.450

670,966

4

 $in^2$ 

0.620

2.170

3.720

5.270

6.820

8.370

9.920

11.470

13.020

14570

16.120

4

cm³(cc)

65.548

229.419

393.290

557.160

721.031

884.901

1048.772

1212.643

1376.513

1540.384

1704.255

in<sup>3</sup>

0 2441

0.8543

1.4646

2.0748

2.6850

3.2952

3.9055

4.5157

5.1259

5.7362

6.3464

161.290

225.806

290.322

354.838

419.354

483.870

548.386

612.902

677.418

5

 $in^2$ 

0.775

2.325

3.875

5.425

6.975

8.525

10.075

11.625

13.175

14.725

16.275

5

cm3(cc)

81.935

245.806

209.677

573.547

737,418

901.289

1065.159

1229.030

1392.900

1556.771

1720.642

5

ın3

0.3051

0.9153

1.5256

2.1358

2.7460

3.3563

3.9665

4.5767

5.1870

5.7972

6 4074

**CUBIC CENTIMETERS TO CUBIC INCHES** 

VOLUME CUBIC INCHES TO CUBIC CENTIMETERS

SQUARE CENTIMETERS TO SQUARE INCHES

ın²	0	1	2	3	4	5	6	7
	cm <sup>2</sup>							

148.387

212.903

277,419

341.935

406.451

470.967

535.483

599.999

664.515

3

 $in^2$ 

0.465

2.015

3.565

5.115

6.665

8.215

9.765

11.315

12.865

14.415

15.965

3

cm3(cc)

49,161

213.032

376.902

540,7.73

704.644

868.514

1032.385

1196.256

1360.126

1523,997

1687.868

3

in<sup>3</sup>

0.1831

0.7933

1.4035

2.0138

2.6240

3.2342

3.8444

4.4547

5.0649

5.6751

6.2854

			340	ANE INC	1123 10 .	JUDANE	OLIVI IIIVI	
ın²	0	1	2	3	4	5	6	7

2	3	4	5	6	7

	SQU	ARE INC	HES TO	SQUARE	CENTIME	ETERS
						7

	squ	ARE INC	HES TO	SQUARE	CENTIME	TERS
_				-	6	7

SQUARE INCHES	TO SQUARE	CENTIMETER

	_	1127	
SQUARE INCHES	то	SQUARE	CENTIMETERS

		_	1127		
COLLABE	INCHES	TΛ	COLLAB	E CENT	IMETED

#### **VOLUME**

#### **GALLONS (U.S.) TO LITERS**

U.S. gal.	0	1	2	3	4	5	6	7	8	9	U.S. gal.
	liters										
		3.7854	7.5709	11.3563	15.1417	18.9271	22.7126	26.4980	30.2834	34.0633	-
10	37.8543	41 6397	45.4251	49.2105	52.9960	56.7814	60.5668	64.3523	68.1377	71.9231	10
20	75 7085	79.4940	83.2794	87.0648	90.8502	94.6357	98.4211	102.2065	105.9920	109.7774	20
30	113.5629	117.3482	121.1337	124.9191	128.7045	132.4901	136.2754	140.0608	143.8462	147.6316	30
40	151 4171	155.2025	158.9879	162.7734	166.5588	170.3442	174.1296	177.9151	181.7005	185.4859	40
50	189.2713	193.0568	196.8422	200.6276	204.4131	208.1985	211.9839	215.7693	219.5548	223.3402	50
60	227 1256	230 9110	234.6965	238.4819	242.2673	246.0527	249.8382	253.6236	257.4090	261.1945	60
70	264.9799	268.7653	272.5507	276.3362	280.1216	283.9070	287.6924	291.4779	295.2633	299.0487	70
80	302 8342	306.6196	310.4050	314.1904	317.9759	321.7613	325.5467	329.3321	333.1176	336.9030	80
90	340.6884	344.4738	348.2593	352.0447	355.8301	359.6156	363.4010	367.1864	370.9718	374.7573	90
100	378.5427	382.3281	386,1135	389.8990	393.6844	397.4698	401.2553	405.0407	408.8261	412.6115	100

#### LITERS TO GALLONS (U.S.)

liters	0	1	2	3	4	5	6	7	8	9	liters
	gal	gal.	gai.								
_		0.2642	0.5283	0.7925	1.0567	1.3209	1.5850	1.8492	2.1134	2.3775	
10	2.6417	2 9059	3.1701	3.4342	3.6984	3.9626	4.2268	4.4909	4.7551	5.0193	10
20	5.2834	5.5476	5.8118	6.0760	6.3401	6.6043	6.8685	7.1326	7.3968	7.6610	20
30	7.9252	8.1893	8.4535	8.7177	8.9818	9.2460	9.5102	9.7743	10.0385	10.3027	30
40	10.5669	10.8311	11.0952	11.3594	11.6236	11.8877	12.1519	12.4161	12.6803	12.9444	40
50	13.2086	13.4728	13.7369	14.0011	14.2653	14.5295	14.7936	15.0578	15.3220	15.5861	50
60	15.8503	16 1145	16.3787	16.6428	16.9070	17.1711	17.4354	17.6995	17.9637	18.2279	60
70	18 4920	18 7562	19.0204	19.2846	19.5487	19.8129	20.0771	20.3412	20.6054	20.8696	70
80	21.1338	21.3979	21.6621	21.9263	22.1904	22.4546	22.7188	22.9830	23.2471	23.5113	80
90	23.7755	24.0397	24.3038	24.5680	24.8322	25.0963	25.3605	25.6247	25.8889	26.1530	90
100	26.4172	26.6814	26.9455	27.2097	27.4739	27.7381	28.0022	28.2664	28.5306	28.7947	100

#### **GALLONS (IMP.) TO LITERS**

Imp gal.	0	1	2	3	4	5	6	7	8	9	imp gal.
	liters										
		4 5459	9.0918	13.6377	18.1836	22.7295	27.2754	31.8213	36.3672	40.9131	
10	45.4590	50.0049	54.5508	59.0967	63.6426	68.1885	72.7344	77.2803	81.8262	86.3721	10
20	90.9180	95.4639	100.0098	104.5557	109.1016	113.6475	118.1934	122.7393	127.2852	131.8311	20
30	136.3770	140.9229	145.4688	150.0147	154.5606	159.1065	163.6524	168.1983	172.7442	177.2901	30
40	181.8360	186.3819	190.9278	195.4737	200.0196	204.5655	209.1114	213.6573	218.2032	222.7491	40
50	227.2950	231.8409	236.3868	240.9327	245.4786	250.0245	254.5704	259.1163	263.6622	268.2081	50
60	272.7540	277.2999	281.8458	286.3917	290.9376	295.4835	300.0294	304.5753	309.1212	313.6671	60
70	318.2130	322.7589	327.3048	331.8507	336.8966	340.9425	345.4884	350.0343	354.5802	359.1261	70
80	363.6720	368.2179	372.7638	377.3097	381.8556	386.4015	390.9474	395.4933	400.0392	404.5851	80
90	409.1310	413.6769	418.2228	422.7687	427.3146	431.8605	436.4064	440.9523	445.4982	450.0441	90
100	454.5900	459.1359	463.6818	468.2277	472.7736	477.3195	481.8654	486.4113	490.9572	495.5031	100

#### LITERS TO GALLONS (IMP.)

liters	0	1	2	3	4	5	6	7	8	9	liter
	gal.	gal.	gai.	gal.	gai.	gal.	gai.	gal.	gal.	gal.	
		0.2200	0.4400	0.6599	0.8799	1.0999	1.3199	1.5399	1.7598	1.9798	_
10	2.1998	2.4198	2.6398	2.8597	3.0797	3.2997	3.5197	3.7397	3.9596	4.1796	10
20	4.3996	4.6196	4.8396	5.0595	5.2795	5.4995	5.7195	5.9395	6.1594	6.3794	20
30	6.5994	6.8194	7.0394	7.2593	7.4793	7.6993	7.9193	8.1393	8.3592	8.5792	30
40	8.7992	9 0192	9.2392	9.4591	9.6791	9.8991	10.1191	10.3391	10.5590	10.7790	40
50	10.9990	11.2190	11.4390	11.6590	11.8789	12.0989	12.3189	12.5389	12.7588	12.9788	50
60	13.1988	13.4188	13.6388	13.8587	14.0787	14.2987	14.5187	14.7387	14.9586	15.1786	60
70	15.3986	15.6186	15.8386	16.0585	16.2785	16.4985	16.7185	16.9385	17.1584	17.3784	70
80	17.5984	17.8184	18.0384	18.2583	18.4783	18.6983	18.9183	19.1383	19.3582	19.5782	80
90	19.7982	20.0182	20.2382	20.4581	20.6781	20.8981	21.1181	21.3381	21.5580	21.7780	90
100	21.9980	22 2180	22.4380	22.6579	22.8779	23.0979	23.3179	23.5379	23.7578	23.9778	100

MASS **POUNDS TO KILOGRAMS** 

lbs.	0	1	2	3	4	5	6	7	8	9	lbs.
	kg										
_		0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082	_
10	4.536	4,990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618	10
20	9.072	9.525	9.979	10.433	10.886	11.340	11.793	12.247	12.701	13.154	20
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690	30
40	18,144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226	40
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762	50
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298	_ 60_
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834	70
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370	80
90	40.823	41.277	41.731	42.184	42.638	43.091	43.545	43.998	44.452	44.906	90
100	45.359	45.813	46.266	46.720	47.174	47.627	47.081	48.534	48.988	49.442	100

#### **KILOGRAMS TO POUNDS**

kg	0	1	2	3	4	5	6	7	8	9	kg
	lbs.	lbs	ibs.								
		2.205	4.409	6.614	8.818	11.023	13.228	15.432	17.637	19.842	_
10	22.046	24.251	26.455	28.660	30.865	33.069	35.274	37.479	39.683	41.888	10
20	44.092	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934	20
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980	30
40	88.185	90.390	92.594	94.799	97.003	99.208	101.413	103.617	105.822	108.026	40
50	110.231	112.436	114.640	116.845	119.050	121.254	123.459	125.633	127.868	130.073	50
60	132.277	134.482	136.687	138.891	141.096	143,300	145.505	147.710	149.914	152.119	60
70	154.324	156.528	158.732	160.937	163.142	165.347	167.551	169.756	171.961	174.165	70
80	176.370	178.574	180.780	182.984	185.188	187.393	189.597	191.802	194.007	196.211	80
90	198.416	200.621	202.825	205.030	207.234	209.439	211.644	213.848	216.053	218.258	90
100	220.462	222.667	224.871	227.076	229.281	231.485	233.690	235.895	238.099	240.304	100

#### **KILOGRAMS TO NEWTON**

kg	0	1	2	3	4	5	6	7	8	9	kg
	N	N	N	N	N	N	N	N	N	N	
	_	9.81	19.61	29.42	39.23	49.03	58.84	68.65	78.45	88.26	
10	98.07	107.87	117.68	127.49	137.29	147.10	156.91	166.71	176.52	186.33	10
20	196.13	205.94	215.75	225.55	235.36	245.17	254.97	264.78	274.59	284.39	20
30	294,20	304.01	313.81	323.62	333.43	343.23	353.04	362.85	372.65	382.46	30
40	392.27	402.07	411.88	421.69	431.49	441.30	451.11	460.91	470.72	480.53	40
50	490.33	500.14	509.95	519.75	529.56	539.37	549.17	558.98	568.79	578.59	50
60	558.40	598.21	608.01	617.82	627.63	637.43	647.24	657.05	666.85	676.66	60
70	686.47	696.27	706.08	715.89	725.69	735.50	745.31	755.11	764.92	774.73	70
80	784.53	794.34	804.15	813.95	823.76	833.57	843.37	853.18	862.99	872.79	80
90	882.60	892.41	902.21	912.02	921.83	931.63	941.44	951.25	961.05	970.86	90
100	980.67	990.47	1000.28	1010.08	1019.89	1029.70	1039.50	1049.31	1059.12	1068.92	100

#### **NEWTON TO KILOGRAMS**

N	0	10	20	30	40	50	60	70	80	90	N
	kg										
_	_	1.020	2.039	3.059	4.079	5.099	6.118	7.138	8.158	9.177	_
100	10.197	11.217	12.237	13.256	14.276	15.296	16.316	17.335	18.355	19.375	100
200	20.394	21.414	22.434	23.453	24.473	25.493	26.513	27.532	28.552	29.572	200
300	30.592	31,611	32.631	33.651	34.670	35.690	36.710	37.730	38.749	39.769	300
400	40.789	41.809	42.828	43.848	44.868	45.887	46.907	47.927	48.947	49.966	400
500	50.986	52.006	53.025	54.045	55.065	56.085	57.104	58.124	59.144	60.163	500
600	61.183	62.203	63.223	64.242	65.262	66.282	67.302	68.321	69.341	70.361	600
700	71.380	72.400	73.420	74.440	75.459	76.479	77.499	78.518	79.538	80.558	700
800	81.578	82.597	83.617	84.637	85.656	86.676	87.696	88.716	89.735	90.755	800
900	91.775	92.795	93.814	94.834	95.854	96.873	97.893	98.913	99.933	100.952	900
1000	101.972	102.992	104.011	105.031	106.051	107.071	108.090	109.110	110.130	111.149	1000

## PRESSURE POUNDS PER SQUARE INCHES TO KILOGRAMS PER SQUARE CENTIMETERS

lb/in²	0	1	2	3	4	5	6	7	8	9	lb/in²
(psi)	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm <sup>2</sup>	(psi)
_		0.0703	0.1406	0.2109	0.2812	0.3515	0 4218	0.4921	0.5625	0.6328	
10	0.7031	0.7734	0.8437	0.9140	0.9843	1.0546	1.1249	1.1952	1.2655	1.3358	10
20	1.4061	1.4764	1.5468	1.6171	1.6874	1.7577	1.8280	1.8983	1.9686	2.0389	20
30	2.1092	2.1795	2.2498	2.3201	2.3904	2.4607	2.5311	2.6014	2.6717	2.7420	30
40	2.8123	2.8826	2.9529	3.0232	3.0935	3.1638	3.2341	3.3044	3.3747	3.4450	40
50	3.5154	3.5857	3.6560	3.7263	3.7966	3.8669	3.9372	4.0075	4.0778	4.1481	50
60	4.2184	4.2887	4.3590	4.4293	4.4996	4 5 7 0 0	4.6403	4.7106	4.7809	4.8512	60
70	4.9215	4.9918	5.0621	5.1324	5.2027	5.2730	5.3433	5.4136	5.4839	5.5543	70
80	5.6246	5.6947	5.7652	5.8355	5.9058	5.9761	6.0464	6 1 1 6 7	6.1870	6.2573	80
9Ó	6.3276	6.3979	6.4682	6.5386	6.6089	6.6792	6.7495	6.8198	6.8901	6.9604	90
100	7.0307	7.1010	7.1713	7.2416	7.3119	7.3822	7 4525	7.5228	7.5932	7 6635	100

#### KILOGRAMS PER SQUARE CENTIMETERS TO POUNDS PER SQUARE INCHES

kg/cm²	0	1	2	3	4	5	6	7	8	9	kg/cm²
	lb/in²(psi)										
		14.22	28.45	42.67	56.89	71.12	85.34	99.56	113.78	128.01	_
10	142.23	156.45	170.68	184.90	199.12	213.35	227.57	241.79	256.01	270.24	10
20	284.46	298.68	312.91	327.13	341.35	355.58	369.80	384.02	398.24	412.47	20
30	426.69	440.91	455.14	469.36	483.58	497.81	512.03	526.25	540.47	554.70	30
40	568.92	583.14	597.37	611.59	625.81	640.04	654.26	668.48	682.70	696.93	40
50	711.16	725.37	739.60	753.82	768.04	782.27	795.49	810.71	824.93	839.16	50
60	853.38	867.60	881.83	896.05	910.27	924.50	938.72	952.94	967.16	981.39	60
70	995.61	1009.83	1024.06	1038.28	1052.50	1066.73	1080.95	1095.17	1109.39	1123.62	70
80	1137.84	1152.06	1166.27	1180.51	1194.73	1208.96	1223.18	1237.40	1251.62	1265.85	80
90	1280.07	1294.20	1308.52	1322.74	1336.96	1351.19	1365.41	1379.63	1393.85	1408.08	90
100	1422.30	1436.52	1450.75	1464.97	1479.19	1493.42	1507.64	1521 86	1536.08	1550.31	100

#### KILOGRAMS PER SQUARE CENTIMETERS TO KILO PASCAL

kg/cm²	0	1	2	3	4	5	6	7	8	9	kg/cm²
	KPa	KPa	KPa	KPa	KPa	KPa	KPa	KPa	KPa	KPa	************
_	_	98.1	196.1	294.2	392.3	490.3	588.4	686.5	784.5	882.6	_
10	980.7	1078.7	1176.8	1274.9	1372.9	1471.0	1569.1	1667.1	1765.2	1863.3	10
20	1961.3	2059.4	2157.5	2255.5	2353.6	2451.7	2549.7	2647.8	2745.9	2843.9	20
30	2942.0	3040.1	3138.1	3236.2	3334.3	3432.3	3530.4	3628.5	3726.5	3824.6	30
40	3922.7	4020.7	4118.8	4216.9	4314.9	4413.0	4511.1	4609.1	4707.2	4805.3	40
50	4903.3	5001.4	5099.5	5197.5	5295.6	5393.7	5491.7	5589.8	5687.9	5785.9	50
60	5584.0	5982.1	6080.1	6178.2	6276.3	6374.3	6472.4	6570.5	6668.5	6766.6	60
70	6864.7	6962.7	7060.8	7158.9	7256.9	7355.0	7453.1	7551.1	7649.2	7747.3	70
80	7845.3	7943.4	8041.5	8139.5	8237.6	8335.7	8433.7	8531.8	8629.9	8727.9	80
90	8826.0	8924.1	9022.1	9120.2	9218.3	9316.3	9414.4	9512.5	9610.5	9708.6	90
100	9806.7	9904.7	10002.8	10100.8	10198.9	10297.0	10395.0	10493.1	10591.2	10689.2	100

#### KILO PASCAL TO KILOGRAMS PER SQUARE CENTIMETERS

KPa	0	100	200	300	400	500	600	700	800	900	KPa
	kg/cm²	kg/cm²	kg/cm²								
	_	1.020	2.039	3.059	4.079	5.099	6.118	7.138	8.158	9.177	
1000	10.197	11.217	12.237	13.256	14.276	15.296	16.316	17.335	18.355	19.375	1000
2000	20.394	21.414	22.434	23.453	24.473	25.493	26.513	27.532	28.552	29.572	2000
3000	30.592	31.611	32.631	33.651	34.670	35.690	36.710	37.730	38.749	39.769	3000
4000	40.789	41.809	42.828	43.848	44.868	45.887	46.907	47.927	48.947	49.966	4000
5000	50.986	52.006	53.025	54.045	55.065	56.085	57.104	58.124	59.144	60.163	5000
6000	61.183	62.203	63.223	64.242	65.262	66.282	67.302	68.321	69.341	70.361	6000
7000	71.380	72.400	73.420	74.440	75.459	76.479	77.499	78.518	79.538	80.558	7000
8000	81.578	82.597	83.617	84.637	85.656	86.676	87.696	88.716	89.735	90.755	8000
9000	91.775	92.794	93.814	94.834	95 854	96.873	97.893	' 98.913	99.933	100.952	9000
10000	101.972	102.992	104.011	105.031	106.051	107.071	108.090	109.110	110.130	111 149	10000

#### TORQUE

#### FOOT POUNDS TO KILOGRAMMETERS

ft. lbs.	0	1	2	3	4	5	6	7	8	9	ft. lbs.
	kg-m										
-		0.138	0.277	0415	0.553	0.691	0.830	0.968	1.106	1.244	_
10	1.383	1.521	1.659	1.797	1.936	2.074	2.212	2.350	2 489	2.627	10
20	2.765	2.903	3.042	3 180	3.318	3.456	3.595	3.733	3.871	4.009	20
30	4.148	4.286	4.424	4.562	4.700	4.839	4.977	5.115	5.253	5.392	30
40	5.530	5.668	5.807	5.945	6.083	6.221	6.360	6.498	6.636	6.774	40
50	6.913	7.051	7.189	7.328	7.466	7.604	7.742	7.881	8.019	8.157	50
60	8.295	8.434	8.572	8.710	8.848	8.987	9.125	9.263	9.401	9.540	60
70	9.678	9.816	9.954	10.093	10.231	10 369	10 507	10.646	10.784	10 922	70
80	11.060	11,199	11.337	11.475	11.613	11.752	11.890	12.028	12.166	12.305	80
90	12.442	12.581	12.719	12.858	12.996	13.134	13.272	13.410	13.549	13.687	90
100	13.826	13.964	14.102	14.240	14.379	14.517	14.655	14.793	14.932	15.070	100

#### **KILOGRAMMETERS TO FOOT POUNDS**

kg-m	0	1	2	3	4	5	6	7	8	9	kg-m
	ft. lbs.	ft. lbs	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.					
		7.23	14.47	21.70	28.93	36 17	43.40	50.63	57.86	65.10	_
10	72.33	79.56	86.80	94.03	101.26	108.50	115.73	122.96	130.19	137.43	10
20	144.66	151.89	159.13	166.36	173.59	180.83	188.06	195.29	202.52	209.76	20
30	217.00	224.22	231.46	238.69	245.92	253.16	260.39	267.62	274.85	282.09	30
40	289.32	296.55	303.79	311.02	318.25	325.49	332,72	339.95	347.18	354.42	40
50	361.65	368.88	376.12	383.35	390.58	397.82	405.05	412.28	419.51	426.75	50
60	433.98	441.21	448.45	455.68	462.91	470.15	477.38	484.61	491.84	499.08	60
70	506.31	513.54	520.78	528.01	535.24	542.48	549.71	556.94	564.17	571.41	70
80	578.64	585.87	593.11	600.34	607.57	614.81	622.04	629.27	636.50	643.74	80
90	650.97	658.20	665.44	672.67	679.90	687.14	694.37	701.60	708.83	716.07	90
100	723.30	730.53	737.77	745.00	752.23	759.47	766.70	773.93	781.16	788.40	100

#### KILOGRAMMETERS TO NEWTONMETERS

kg-m	0	1	2	3	4	5	6	7	8	9	kg-m
	N-m	N-m	N-m	N-m	N-m	N-m	N-m	N-m	N-m	N-m	
		9.81	19.61	29.42	39.23	49.03	58.84	68.65	78.45	88.26	_
10	98.07	107.87	117.68	127.49	137.29	147.10	156 91	166.71	176.52	186.33	10
20	196.13	205.94	215.75	225.55	235.36	245.17	254.97	264.78	274.59	284.39	20
30	294.20	304.01	313.81	323.62	333.43	343.23	353.04	362.85	372.65	382.46	30
40	392.27	402.07	411.88	421.69	431.49	441.30	451.11	460.91	470.72	480.53	40
50	490.33	500.14	509.95	519.75	529.56	539.37	549.17	558.98	568.79	578.59	50
60	588.40	598.21	608.01	617.82	627.63	637.43	647.24	657.05	666.85	676.66	60
70	686.47	696.27	706.08	715.89	725.69	735.50	745.31	755.11	764.92	774.73	70
80	784.53	794.34	804.15	813.95	823.76	833.57	843.37	853.18	862.99	872.79	80
90	882.60	892.41	902.21	912.02	921.83	931.63	941.44	951.25	961.05	970.86	90
100	980.67	990.47	1000.28	1010.08	1019.89	1029.70	1039.50	1049.31	1059.12	1068.92	100

#### **NEWTONMETERS TO KILOGRAMMETERS**

N-m	0	10	20	30	40	50	60	70	80	90	N-m
	kg-m										
_		1.020	2.039	3.059	4.079	5.099	6 1 1 8	7.138	8.158	9.177	
100	10.197	11.217	12.236	13.256	14,276	15.296	16.315	17.335	18.355	19.374	100
200	20.394	21.414	22.433	23.453	24.473	25.493	26.512	27.532	28.552	29.571	200
300	30.591	31.611	32.630	33.650	34.670	35.690	36.710	37.729	38.749	39.768	300
400	40.789	41.808	42.827	43.847	44.867	45.887	46.906	47.926	48.946	49.965	400
500	50.986	52.005	53.024	54.044	55.064	56.084	57.103	58.123	59.143	60.162	500
600	61.183	62.202	63.221	64.241	65.261	66.281	67.300	68.320	69.340	70.359	600
700	71.380	72.399	73.418	74.438	75.458	76.478	77.497	78.517	79.537	80.556	700
800	81.577	82.596	83.615	84.635	85.655	86.675	87.694	88.714	89.734	90.753	800
900	91,774	92.793	93.812	94.832	95.852	96.872	97.891	98.911	99.931	100.950	900
1000	101.972	102.990	104.009	105.029	106.049	107.069	108 088	109.108	110.128	111.147	1000

-24

-23

-22

-21

-20

-11.2

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-7.6

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-4.4

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46.4

48.2

50.0

51.8

53.6

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41

42

43

44

104.0

105.8

107.6

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111.2

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74

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161.6

163.4

165.2

167.0

168.8

104

105

106

107

108

219.2

221.0

222.8

224.6

226.4

136

137

138

139

140

#### **TEMPERATURE**

#### **FAHRENHEIT TO CENTIGRADE**

°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	۰F	°C	°F	°C	°F	°C
-60	-51.1	-2	-18.9	56	13.3	114	45.6	172	77.8	230	110.0	288	142.2	346	174.4
-58	-50	0	-17.8	58	14.4	116	46.7	174	78.9	232	111.1	290	143.3	348	175.6
-56	-48.9	2	-16.7	60	15.6	118	47.8	176	80.0	234	112.2	292	144.4	350	176.7
-54	-47.8	4	-15.6	62	16.7	120	48.9	178	81.1	236	113.3	294	145.6	352	177.8
-52	-46.7	6	-14.4	64	17.8	122	50.0	180	82.2	238	114.4	296	146.7	354	178.9
-50	-45.6	8	-13.3	66	18.9	124	51.1	182	83.3	240	115.6	298	147.8	356	180.0
-48	-44.4	10	-12.2	68	20.0	126	52.2	184	84.4	242	116.7	300	148.9	358	181.1
-46	-43.3	12	-11.1	70	21.1	128	53.3	186	85.6	244	117.8	302	150.0	360	182.2
-44	-42.2	14	-10.0	72	22.2	130	54.4	188	86.7	246	118.9	304	151.1	362	183.3
-42	-41.1	16	-8.9	74	23.3	132	55.6	190	87.8	248	120.0	306	152.2	364	184.4
-40	-40.0	18	-7.8	76	24.9	134	56.7	192	88.9	250	121.1	308	153.3	366	185.6
-38	-38.9	20	-6.7	78	25.6	136	57.8	194	90.0	252	122.2	310	154.4	368	186.7
-36	-37.8	22	-5.6	80	26.7	138	58.9	196	91.1	254	123.3	312	155.6	370	187.8
-34	-36.7	24	-4.4	82	27.8	140	60.0	198	92.2	256	124.4	314	156.7	372	188.9
-32	-35.6	26	-3.3	84	28.9	142	61.1	200	93.3	258	125.6	316	157.8	374	190.0
-30	-34.4	28	-2.2	86	30.0	144	62.2	202	94.4	260	126.7	318	158.9	376	191.1
-28	-33.3	30	-1.1	88	31.1	146	63.3	204	95.6	262	127.8	320	160.0	378	192.2
-26	-32.2	32	-0	90	32.2	148	64.4	206	96.7	264	128.9	322	161.1	380	193.3
-24	-31.1	34	1.1	92	33.3	150	65.6	208	97.8	266	130.0	324	162.2	382	194.4
-22	-30.0	36	2.2	94	34.4	152	66.7	210	98.9	268	131.1	326	163.3	384	195.6
-20	-28.9	38	3.3	96	35.6	154	67.8	212	100.0	270	132.2	328	164.4	386	196.7
-18	-27.8	40	4.4	98	36.7	156	68.9	214	101.1	272	133.3	330	165.6	388	197.8
-16	-26.7	42	5.6	100	37.8	158	70.0	216	102.2	274	134.4	332	166.7	390	198.9
-14	-25.6	44	6.7	102	38.9	160	71.1	218	103.3	276	135.6	334	167.8	392	200.0
-12	-24.4	46	7.8	104	40.0	162	72.2	220	104.4	278	136.7	336	168.9	400	204.4
-10	-23.3	48	8.9	106	41.1	164	73.3	222	105.6	280	137.8	338	170.0	410	210.0
-8	-22.2	50	10.0	108	42.2	166	74.4	224	106.7	282	138.9	340	171.1	420	215.6
-6	-21.1	52	11.1	110	43.3	168	75.6	226	107.8	284	140.0	342	172.2	430	221.1
-4	-20.0	54	12.2	112	44.4	170	76.7	228	108.9	286	141.1	344	173.3	440	226.7
						CENT	IGRAD	е то	FAHRE	NHEIT	•				

#### °C 78 172.4 110 230.0 142 287.6 174 345.2 57.2 46 114.8

°C

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280.4

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168

169

170

171

172

334.4

336.4

338.0

339.8

341.6

200

210

220

230

240

392.0

410.0

428.0

446.0

464.0

°C

°C

°C

-49	-56.2	-17	1.4	15	59.0	47	116.6	79	174.2	111	231.8	143	289.4	175	347.0
-48	-54.4	-16	3.2	16	60.8	48	118.4	80	176.0	112	233.6	144	291.2	176	348.8
-47	-52.6	-15	5.0	17	62.6	49	120.2	81	177.8	113	235.4	145	293.0	177	350.6
-46	-50.8	-14	6.8	18	64.4	50	122.0	82	179.6	114	237.2	146	294.8	178	352.4
-45	-49.0	-13	8.6	19	66.2	51	123.8	83	181.4	115	239.0	147	296.6	179	354.2
-44	-47.2	-12	10.4	20	68.0	52	125.6	84	183.2	116	240.8	148	298.4	180	356.0
-43	-45.4	-11	12.2	21	69.8	53	127.4	85	185.0	117	242.6	149	300.2	181	357.8
-42	-43.6	-10	14.0	22	71.6	54	129.2	86	186.8	118	244.4	150	302.0	182	359.6
-41	-41.8	-9	15.8	23	73.4	55	131.0	87	188.6	119	246.2	151	303.8	183	361.4
-40	-40.0	-8	17.6	24	75.2	56	132.8	88	190.4	120	248.0	152	305.6	184	363.2
-39	-38.2	-7	19.4	25	77.0	57	134.6	89	192.2	121	249.8	153	307.4	185	365.0
-38	-36.4	-6	21.2	26	78.8	58	136.4	90	194.0	122	251.6	154	309.2	186	366.8
-37	-34.6	-5	23.0	27	80.6	59	138.2	91	195.8	123	253.4	155	311.0	187	368.6
-36	-32.8	-4	24.8	28	82.4	60	140.0	92	197.6	124	255.2	156	312.8	188	370.4
-35	-31.0	-3	26.6	29	84.2	61	141.8	93	199.4	125	257.0	157	314.6	189	372.2
-34	-29.2	-2	28.4	30	86.0	62	143.6	94	201.2	126	258.8	158	316.4	190	374.0
-33	-27.4	-1	30.2	31	87.8	63	145.4	95	203.0	127	260.6	159	318.2	191	375.8
-32	-25.6	0	32.0	32	89.6	64	147.2	96	204.8	128	262.4	160	320.0	192	377.6
-31	-23.8	1	33.8	33	91.4	65	149.0	97	206.6	129	264.2	161	321.8	193	379.4
] -30	-22.0	2	35.6	34	93.2	66	150.8	98	208.4	130	266.0	162	323.6	194	381.2
-29	-20.2	3	37.4	35	95.0	67	152.6	99	210.2	131	267.8	163	325.4	195	383.0
-28	-18.4	4	39.2	36	96.8	68	154.4	100	212.0	132	269.6	164	327.2	196	384.8
-27	-16.6	5	41.0	37	98.6	69	156.2	101	213.8	133	271.4	165	329.0	197	386.6
-26	-14.8	6	42.8	38	100.4	70	158.0	102	215.6	134	273.2	166	330.8	198	388.4
-25	-13.0	7	44.6	39	102.2	71	159.8	103	217.4	135	275.0	167	332.6	199	390.2

## ISUZU<br/>KB - SERIES

## **WORKSHOP MANUAL**

**SECTION OB** 

MAINTENANCE AND LUBRICATION

## SECTION 0B MAINTENANCE AND LUBRICATION

#### **TABLE OF CONTENTS**

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Severe Conditions Maintenance Schedule	0B	6
Recommended Lubricants and Diesel Fuels	0B-	7
Oil Viscosity Chart	0B-	9

#### MAINTENANCE SCHEDULE

#### MAINTENANCE SCHEDULE ABBREVIATIONS

V Variation (Optional equipment on some model).

**G** For gasoline engine models only.

**D** For diesel engine models only.

MT For manual transmission.

**AT** For Automatic transmission.

**4JA** For 4JA1 engine model

**4JT** For turbocharged 4JB1 engine model

Items followed by an asterisk (\*) require more frequent maintenance if the vehicle is driven under severe conditions.

Refer to "SEVERE CONDITIONS MAINTENANCE SCHEDULE."

#### MAINTENANCE SCHEDULE (THIS SCHEDULE IS NOT APPLIED FOR EUROPE)

1: Inspect and correct or replace as necessary

A: Adjust

R: Replace or change T: Tighten

T: Tighten to specified torque

L: Lubricate

SERVICE INTERVAL:	× 1,000 km.	1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
				. •	,,,				00				00	•	-	, 0	, 0	00	00	00	-	100
(Use odometer reading	$\times$ 1,000 miles.	0.6	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
or months whichever		i																				
comes first)	or months		3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
ENGINE																						
Idling speed and accelerat	ion	-	1	1	ł	ł	1	1	1	1	i	1	1	1	1	1	}	1	١	ł	1	1
*Aır cleaner element		-	-	i	-	ŀ	-	I	-	R	-	Ţ	-	1	-	1	R	J	-	1	-	I
<b>V</b> Dry air cleaner elem	nent	-	ì	ì	ì	i	i	i	ì	R	1	}	1	1	1	i	1	R	1	i	1	1
V G Pre air clearner		-	-	ı	-	1	-	-	-	1	-	-	-	1	-	1	-	-1	-	1	-	-1
*Engine oil		-	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Oil leakage and contamina	ation	-	1	- 1	-	1	1	1	]	1	i	1	1		1	1		1	1	1	-	1
* G 4JT Oil filter		-	R	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R	-	R
* 4JA Oil filter		-	R	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-
Fuel leakage		-	1	1	1	ł	1	1	i	1	ł	i	1	1	1	ł	1	1	- 1	1	1	1
<b>G</b> Cylinder head bolts																						
Valve clearances		-	Α	-	-	Α	-	-	-	Α	-	-	-	Α	-	-	-	Α	-	-	-	Α
<b>G</b> Fuel filter		-	-	-	-	R	-	-	-	R	-	-	-	R	-	-	-	R	•	-	-	R
<b>D</b> Fuel filter		-	-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-	R	-	-
<b>G</b> Fuel pump function		-	-	-	-	1	-	-	-	i	-	-	-	1	-	-	-		-	-	-	İ
Fuel tank		-	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	1
D Injection nozzle pres	ssure and									,												
spraying condition		-	-	į.	-	ļ	-	1	-	1	-	!	-	1	-	1	-	1	-	1	-	1
D Injection timing		-	-	4	-	i	-	1	-	1	-	ı	-	!	-	ı	-		-	1	-	1
Compression pressure		-	-	-	-	!	-	-	-	!	-	-	-	J	-	-	-	1	-	-	-	- 1
G Carburetor function		-	ł	1	١	1	ł	ı	ı		ı	ı	ı	ŀ	ı	ļ	ı	!	ſ	i	ı	
G Distributor cam and		-	-	-	-	Ļ	-	-	-	L	-	-	-	L	-	-	-	L	-	-	-	L
G Distributor cap and		-	j	,	,	J	J	j	ļ	ı	J	J	J	J	J	1	J	J	1	- 1	1	I
G Distributor vacuum	advance			,		,																
function		-	-	1	-	1	-	i	-	!	-		-	l	-	i .	-	l	-	l	-	l
G Spark plugs		-		ı	1	!	!	!		i	1		1	1	i			- [	!	1	1	!
G Ignition timing		-	!	1			l .	Į.	1						!	!	!		1	!	1	l .
Cooling system for water		-	1	1	!	,	- !	1	1	1	1	,	1	!	1	ı	!	!		!	!	
Fan belt tension and dam:	age	-	1	1	1	t	1	١	1	ł	,	1	1	1	1	1	1	ŀ	ļ	1	1	ł
*Exhaust pipes and mounti	ngs damage									,				,								
or looseness		-	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	1
Radiator coolant		-	-	-	-	R	-	-	-	н	-	-	-	К	-	-	-	К	-	-	-	R
All hoses and pipes in eng												1										
ment for clogs or damag	ge	-	-	ı	-	ı	-	J	-	i	-	ł	-	i	-	1	-	I	-	1	-	1
Timing belt		-	•	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R
CLUTCH																						
Clutch fluid		-	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	1
Clutch function		-	1	1	1	1	l	1	1	i	1	1	1	1	1	1	1	1	1	1	ł	1
Clutch pedal travel and fre	ee plav	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	ı	1	i	1	1

R: Replace or change	replace as nece T: Tighten to s		fied	tord	ue		L:	Lub	rica	te												
SERVICE INTERVAL:	× 1,000 km.	1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
(Use odometer reading or months whichever	× 1,000 miles.	0.6	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
comes first)	or months	_	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
TRANSMISSION OR TRAN WITH TRANSFER CASE	ISMISSION																					
*Transmission or transmiss transfer case oil	sion with	_	_	R	_	_	-	_	_	R	_	_	_	_	-	_	_	R	-	_	_	_
Automatic transmission f	luid	-	_	-	-	_	-	-	_	ï	-	_	-	-	-	-	+	ï	-	-	_	R
Oil leakage		1	İ	1	1	1	1	į	1	1	i	1	Ī	1	1	1	i	i	1	i	1	1
Gear control mechanism	for looseness	-	-	-	-	1	-	-	-	1	-	-	-	1	•	-	-	İ	-	-	-	1
PROPELLER SHAFT																						
Loose connections		-	-	ı	-	ı	-	ı	-	ı	-	ļ	-	i	-	1	-	1	-	1	-	ı
*Universal joints and spline		-	-	-	-		-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	1
Universal joints and spline	es	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
FRONT AND REAR AXLE																						
*Differential gear oil (Front	and rear)	_	-	R	-	-	-	-	-	R	-	-	-	-	-	-	-	R	-	_	-	-
Oil leakage		1	1	!	1	1	1	1	-1		1	ł	İ	1	1	-	1	1	ŀ	1	I	1
Axle shafts for distortion Axle case for distortion or		-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	1
STEERING	r damage					'				'				ı							_	'
Steering gear oil		-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Power steering fluid		-	-	-	-	-	-	-	-	-	-	R I	-	-	-	-	-	-	-	-	-	ĸ
Oil leakage *Steering system for loose	enass or	•	r	'	٠	1	'	1	ı	1	1	1	ı	ı	ı	1	ı	,	1	'	1	'
damage		_	_	1	_	1	-	ı	_	1	_	ŀ	_	1	-	1	_	l	_	ı	-	ı
Power steering hose		-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-
Steering wheel play		-	I	İ	l	1	- 1	-	1	1	1	I		1	1	1	1	1	1		1	1
Steering function		-	1		ı	1	I	ı	I	1	ı	I	1	ı	1	I	1	ŀ	ı	1	1	1
Right and left turning radi	ius	-	-	-	-	-	-	-	-	ŀ	-	-	-	ı	-	•	-	1	-	-	-	1
Wheel alignment Joint ball		-	-	1	-	i I	-	-	-	ŀ	-	1	-	ŀ	-	- 	-	1	-	- I	-	ŀ
SERVICE BRAKES																						
Brake fluid		_	_	_	_	ı	_	_	_	ı	_	_	_	ı	_	_	_	1	_	_	_	1
Brake system for fluid lea	ıkage	-	1	1	1	i	1	1	ı	i	ı	1	ì	ĺ	1	ı	ı	i	1	i	1	i
Brake function	_	-	1	ł	1	ŀ	1	i	ı	ŀ	1	1	1	1	i	1	1	1	1	Ì	1	I
*Rear brake lining and durr		-	-	I	-	1	-	1	-	I	-	i	-	1	-	ı	-	I	-	1	-	1
*Front disc brake pads and		-	-	ļ	-	1	-	!	-	ı	-	ļ	-	į	-	1	-	1	-	!	-	
Brake pedal travel and fre		İ	ı	ı	i	I	ı	1	1	ı	I	1	I	i	I	I	I	I	I	I	I	I
Pipes and hoses for loose or damage	connections																					

Inspect and correct or replace as necessary A: Adjust Replace or change T: Tighten to specified torque L: Lubricate 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 SERVICE INTERVAL:  $\times$  1.000 km. 1 5 10 15 20 25 (Use odometer reading  $\times$  1.000 miles, 0.6 3 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 or months whichever comes first) or months 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 PARKING BRAKE Parking brake function Parking brake lever travel Cables for looseness or damage and guide for damage Ratchet for wear or damage SUSPENSION Spring leaves for damage Mount for looseness or damage Shock absorbers for oil leakage Shock absorbers mount for looseness Rubber bushes of suspension wear or damage Spring action for loss of balance due to weakening WHEELS Wheel pins Wheel disc for damage Hub bearing grease Front and rear hub bearings for looseness Tire pressure and damage Tire rotation **ELECTRICAL EQUIPMENT** Starter function Specific gravity of battery electrolyte Wiring harness and terminal for looseness or damage Starter brushes for wear Alternator brushes for wear **OTHERS** Vehicle height ļ Bolts and nuts on chassis and body ŀ ı 1

#### SEVERE CONDITIONS MAINTENANCE SCHEDULE

#### (THIS SCHEDULE IS NOT APPLIED FOR EUROPE)

#### Severe driving conditions

Repeated short trips A: B: Driving on rough roads C:

Driving on dusty roads

D: Driving in extremely cold weather and/or on salted roads

lk a ma	Interval	Condition									
ltem	Interval	Α	В	С	D	A+D					
Engine oil	Change every 2,500 km (1,500 miles)			•		•					
Engine oil filter	G 4JT Replace every 5,000 km (3,000 miles)  4JA Replace every 7,500 km (4,500 miles)			•		•					
Exhaust pipes and mounting	Inspect every 10,000 km (6,000 miles)	•	•		•						
Air cleaner element	Replace every 20,000 km (12,000 miles)			•							
Steering system for looseness or damage	Inspect every 5,000 km (3,000 miles)		•								
Universal joints and sleeve for wear	Inspect every 10,000 km (6,000 miles)		•								
Transmission or transmission with tranfer case	Change every 20,000 km (12,000 miles) after changing at the initial 10,000 km (60,000 miles)		•								
Differential oil	Change every 20,000 km (12,000 miles) after changing at the initial 10,000 km (6,000 miles)		•								
Rear brake lining and drum	Inspect every 5,000 km (3,000 miles)	•	•	•							
Front brake pads and disc	Inspect every 5,000 km (3,000 miles)	•	•	•							

#### RECOMMENDED FLUIDS, LUBRICANTS AND FUELS

In order to obtain maximum performance and longest service life from your ISUZU vehicles, it is very important to select and use correctly best lubricants and diesel fuels.

When lubricating, be sure to use ISUZU genuine lubricants or recommended lubricants listed below, according to the maintenance schedule for each vehicle model.

The lubrication intervals in the maintenance schedule and the coverage and period of new vehicle warranty are based on the use of ISUZU genuine lubricants or recommended lubricants as given in the chart which will serve as a guide for selecting lubricants of proper brand name.

LUBRICATION	MAKE	BRAND / TYPE	GRADE
Diesel engine crankcase	ISUZU GENUINE ISUZU GENUINE ISUZU GENUINE EXXON / ESSO MOBIL CALTEX / CHEVRON SHELL	BESCO MULTI – Z TYPE CE (10W-30) BESCO MULTI – Z (10W-30) BESCO S – 3 (10W, 20W, 30, 40) ESSOLUBE XD-3+ (15W-40) MOBIL DELVAC XHP (10W-30, 15W-40) DELO CXJ (15W-40, 30, 40) SHELL RIMULA D OIL (30)	CE CD CD CF-4 / CF CF / CE CF CD
Gasoline engine crankcase	ISUZU GENUINE ISUZU GENUINE ISUZU GENUINE EXXON / ESSO EXXON / ESSO MOBIL CALTEX / TEXACO SHELL	BESCO RACING ACE (7.5W-30) BESCO MULTI ACE (7.5W-30) BESCO ACE (10W-30) ESSO SUPER FLO XT (15W-40, 20W-50) ESSO MAXXOIL (15W-40, 20W-50) MOBIL SUPER XHP (15W-40, 15W-50, 20W-50) HAVOLINE FORMULA-3 (15W-40, 20W-50) SHELL HELIX ULTRA (5W-40)	SG SF SE S 등 등 등 등 등 등 등 등 등
Manual transmission Transfer case	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX / TEXACO SHELL	BESCO GEAR OIL TRANSAXLE (5W-30) ESSOLUBE XD-3+ (15W-40) MOBIL SUPER (10W-30) HAVOLINE FORMULA-3 (15W-40, 20W-50) SHELL MYRINA (15W-40)	CF-4 / CF SH SH CD
Differential Shift on the fly system (GL-5 only)	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX SHELL	BESCO GEAR OIL SH (80W-90, 90, 140) ESSO GEAR OIL GX (85W-90) MOBILUBE HD (80W-90, 85W-140) THUBAN GL-5 EP (80W-90, 85W-140) SHELL SPIRAX HD (90, 140)	GL-5 GL-5 GL-5 GL-5 GL-5
Differential (Limited Slip Differential)	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX	BESCO GEAR OIL LSD (140) ESSO GEAR OIL LSA (90) MOBILUBE HD LS (80W-90) GEAR OIL LSD (90)	<b>GL</b> -5 GL-5 GL-5 GL-5
Automatic transmission Power steering	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX SHELL	BESCO ATF ESSO ATF D (DEXRON® II-D) MOBIL ATF (DEXRON® II-E) ATF HD (DEXRON® II) SHELL DONAX TA (DEXRON® II-D)	
Propeller shaft sliding yoke, Universal joint Clutch shift block Grease fitting	ISUZU GENUINE EXXON / ESSO MOBIL CALTEX / TEXACO SHELL	BESCO L-2 GREASE (No.2), L-3 GREASE (No.3) BEACON 2 (No.2), 3 (No.3) MOBIL GREASE HP (No.2, No.3) STARPLEX-2 (No.2) SHELL RETINAX A (No.2)	

FLUID	ТҮРЕ	
Clutch and brake fluid reservior	Hydraulic brake fluid SAE J1703 FMVSS 116 DOT.3 grade	
Engine cooling system	Good quality ethylene glycol antifreeze	

#### NOTE:

When the recommended lubricants are specified in the workshop manual, follow them.

#### 0B-8 MAINTENANCE AND LUBRICATION

Based on SAE J-313C

BS (BRITISH STANDARD)
Based on BS/2869-1970

DIESEL FUEL/APPLICABLE STANDARD

JIS (JAPANESE INDUSTRIAL STANDARD)	No. 2
DIN (DEUTSCHE INDUSTRIE NORMEN)	DIN 51601
SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)	

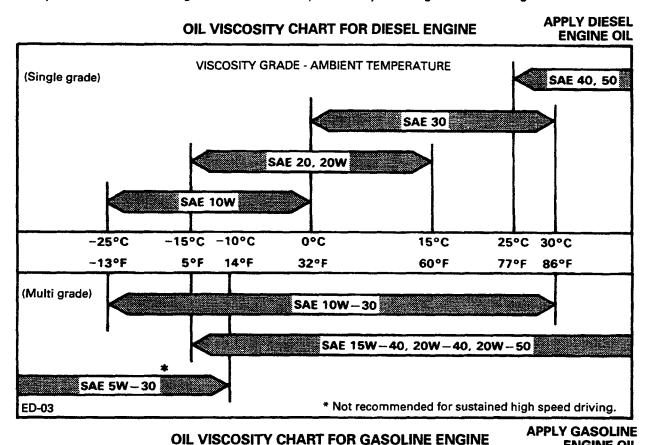
RECOMMENDATION

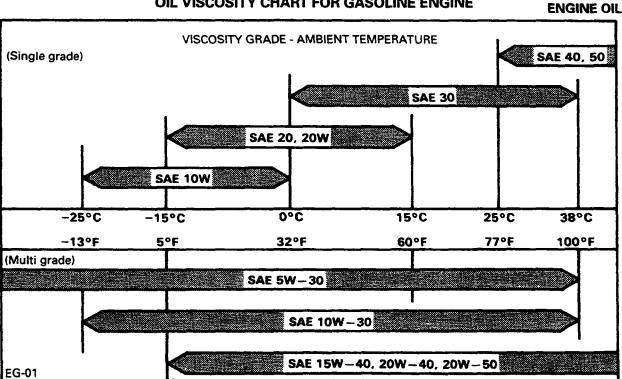
No. 2-D

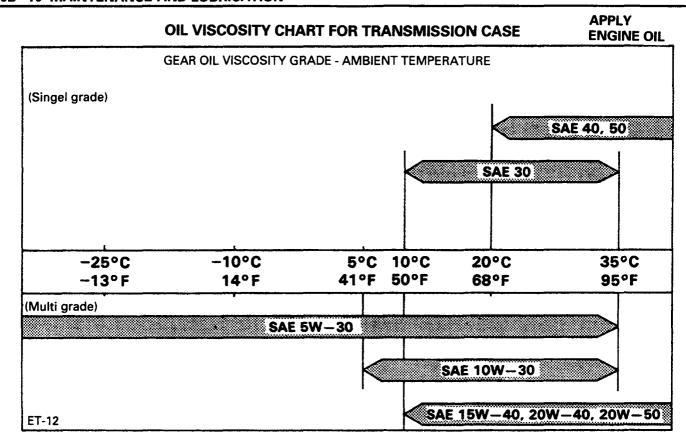
Class A-1

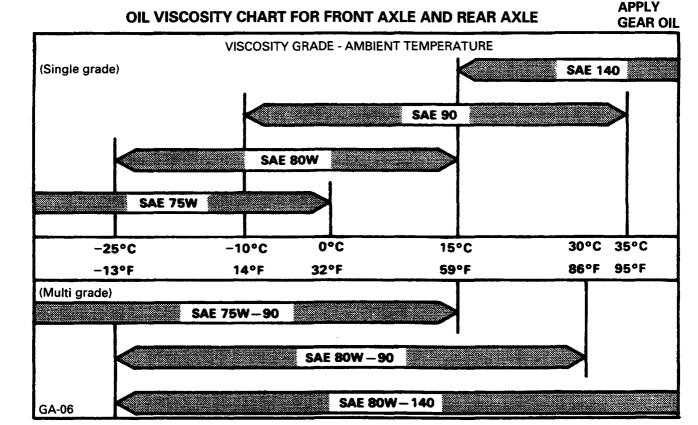
#### OIL VISCOSITY CHART

Lubricants should be carefully selected according to the lubrication chart. It is also important to select viscosity of lubricants according to the ambient temperature by referring to the following table.











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Servicing

Compressor

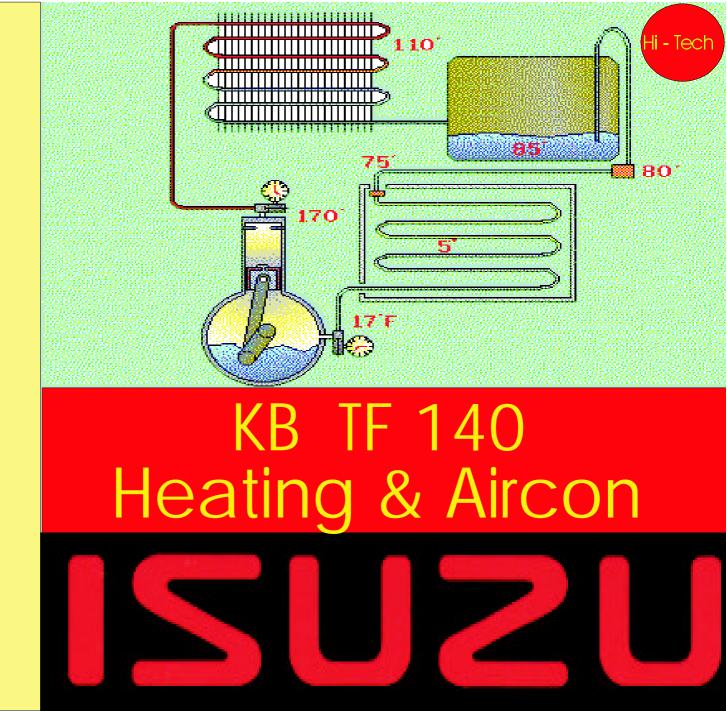
Condenser

Receiver

Evaporator

Blower

Heater



#### **SECTION 1**

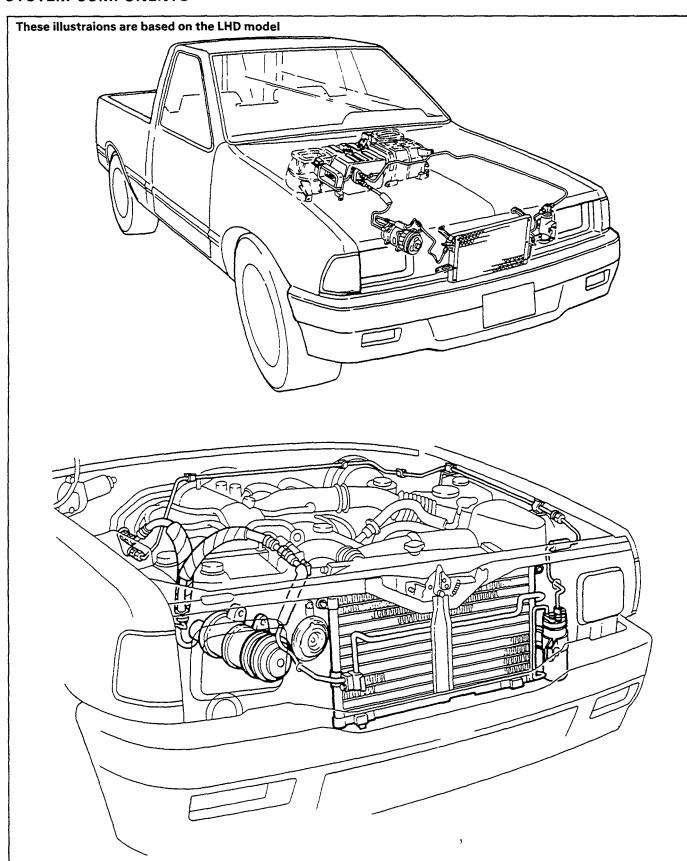
#### **HEATING AND AIR CONDITIONING**

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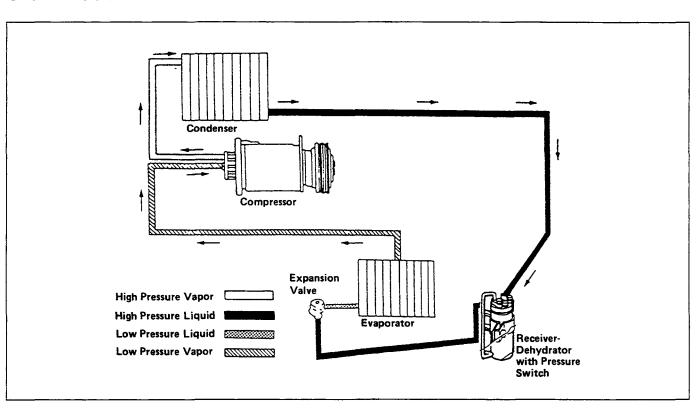
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#### **GENERAL DESCRIPTION**

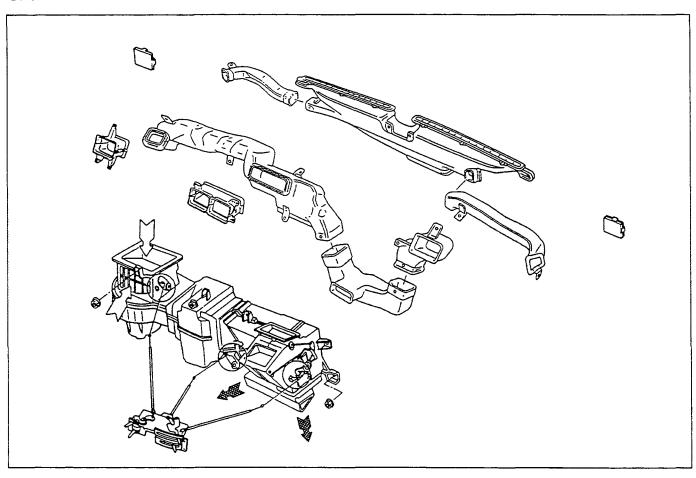
#### **SYSTEM COMPONENTS**



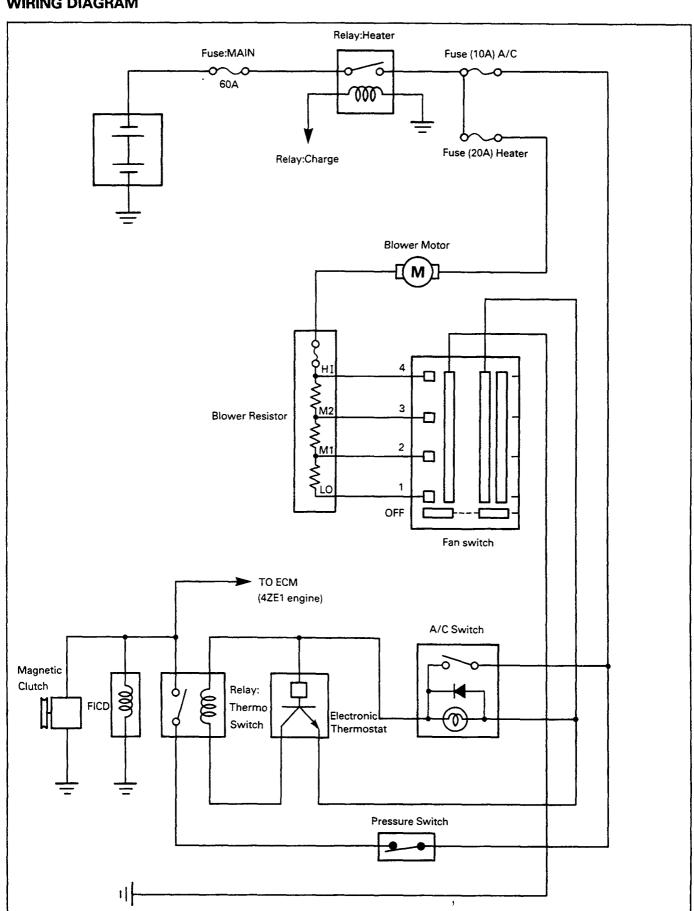
#### SYSTEM COOLING LINE



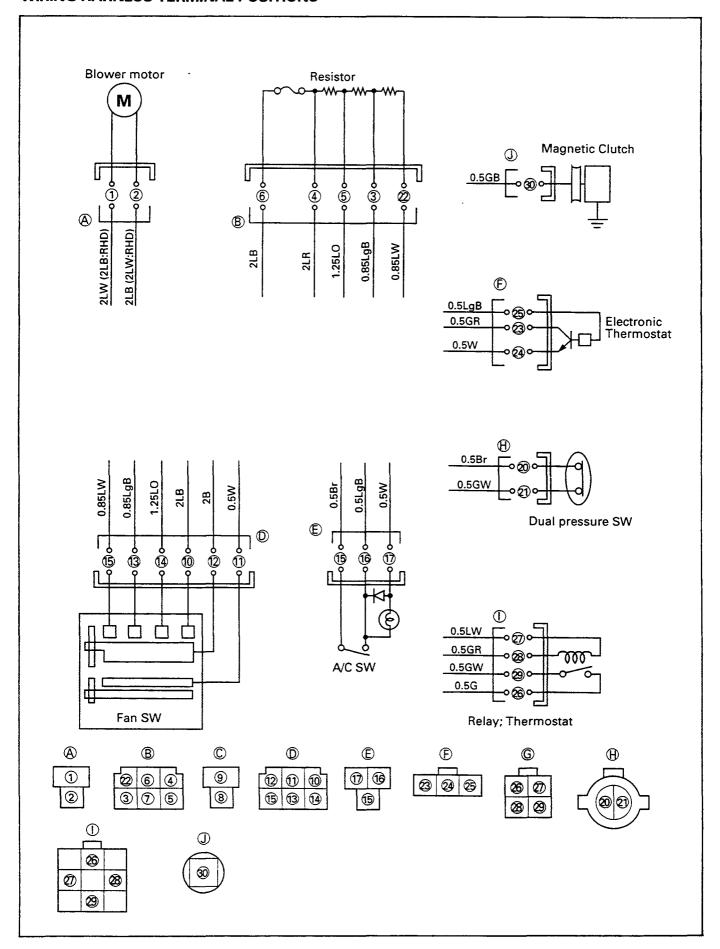
#### UNIT



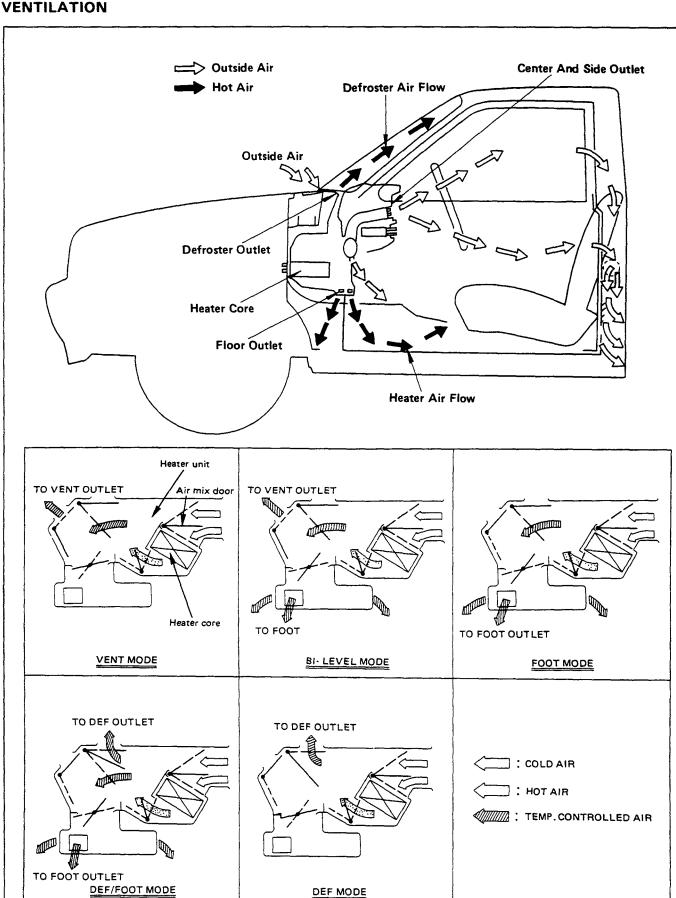
#### **WIRING DIAGRAM**



#### WIRING HARNESS TERMINAL POSITIONS



# 1 - 6 HEATING AND AIR CONDITIONING



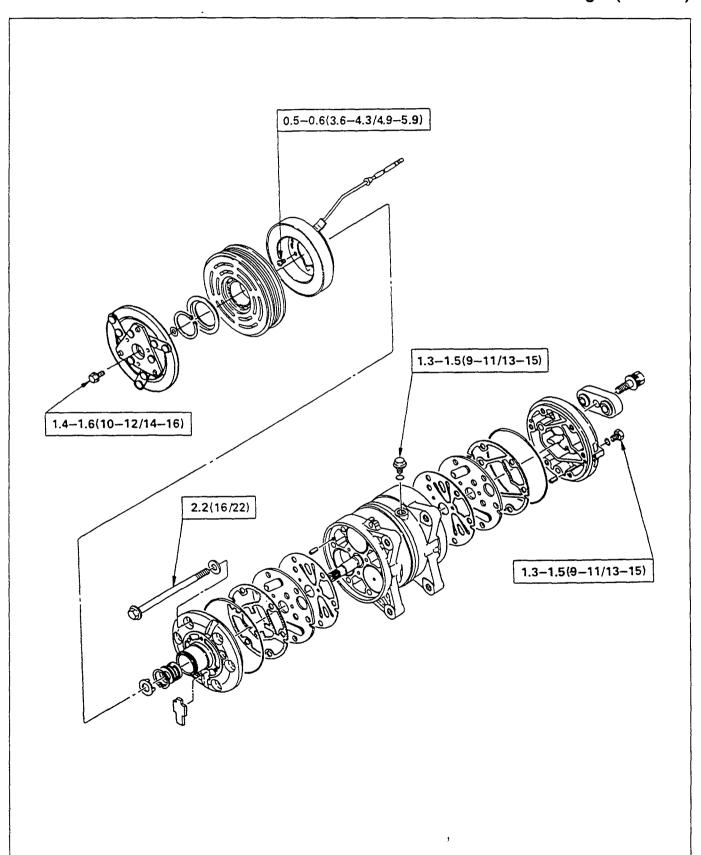
# MAIN DATA AND SPECIFICATION

COMPRESSOR (SD7H13)			
Fitting type			Tube- "O"
Fitting location	I		Cylinder head
Number of cylinders			7
Bore			ø29.3mm
Stroke			27.4 mm
Displacement per revolution			129.2cc/rev
Maximum speed (absolute)			700rpm
Maximum speed (continuous)			6000rpm
Refrigerant			R-134a
Oil type			Sanden PAG SP-20
Oil amount			135cc ± 15cc
Clutch voltage			12V DC
Weight			6.9 kgs
Direction of rotation			Clockwise
HEATING UNIT	:		
Туре			Air mix type
Core dimension	mm (in.)	(L x H x W)	161 (6.34) x 163 (6.42) x 45 (1.77)
Capacity	(kcal./hr.)		3700 kcal./hr. (280 m³/hr.)
BLOWER UNIT			
Туре			Sirocco fan type
COOLING UNIT	:		
Туре			Fin and tube evaporator
Evaporator element dimensions	mm (in.)	(L x H x W)	235 (9.25) x 224 (8.82) x 74 (2.91)
Evaporator capacity	(kcsl./hr.)		4200 kcal./hr. (470 m³/hr.)
CONDENSER			
Туре			Aluminium louvered fins
Capacity	(kcal./hr.)		9400 kcal./hr.
REFRIGERANT		Type: R-134a Capacity: 0,75 kg ± 50 gramms	
IDLE SPEED-UP CONTROL		ldie	e speed controlled by solenoid switch (Petrol models only)

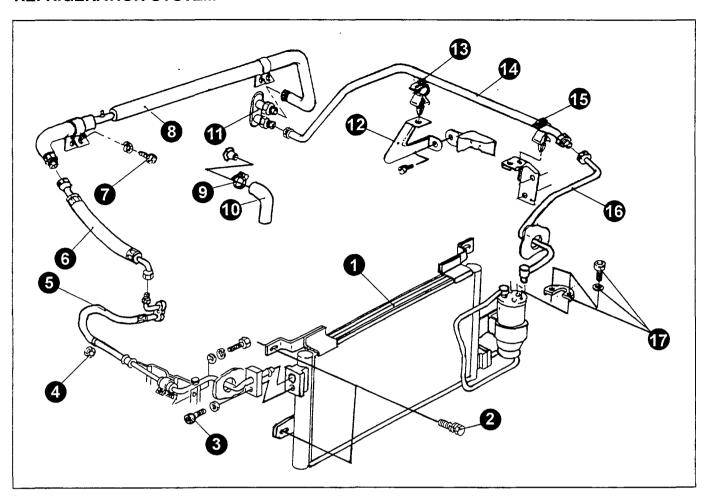
# SPECIAL PARTS AND FIXING NUTS AND BOLTS

**COMPRESSOR ASSEMBLY** 

kg•m(lb.ft/N.m)



## REFRIGERATION SYSTEM



# **Parts List**

- 1. Condensor
- 2. Bolt condensor to body
- ▲ 3. Bolt pipe assembly to condensor
- ▲ 4. Nut
  - 5. Hose assembly compressor to condensor
- ▲ 6. Hose assembly compressor to joint
  - 7. Screw
- ▲ 8. Pipe assembly evaporator to joint
  - 9. Clamp
  - 10. Evaporator drain hose
  - 11. Evaporator in/outlet
  - 12. Bracket
  - 13. Clip
- ▲ 14. Pipe assembly evaporator to receiver/drier joint
  - 15. Clip
- ▲ 16. Pipe assembly receiver to joint
- ▲ 17. Bracket and bolt pipe to receiver/drier fix

# Important Operations - Installation

Tightening Torque:

- 2. Bolt condensor to body 8 17 N.m.
- 3. Bolt pipe assembly to condensor 12 17 N.m
- 4. Nut 4 8 N.m
- 6. Hose assembly compressor to joint 15 25 N.m.
- 8. Pipe assembly evaporator to joint 20 29 N.m
- 14. Pipe assembly evaporator to receiver/drier joint 10 -20 N.m.
- 16. Pipe assembly receiver to joint 10 20 N.m
- 17. Bracket and bolt pipe to receiver/drier fix 4 8 N.m.

# **SERVICING**

# PRECAUTION FOR REFRIGERANT - 134a (R-134a) AIR CONDITIONING SYSTEM

R-12 and R134a systems require different types of lubricating oil. Components designed solely for use with one refrigerant and oil type must never be interchanged with components designed solely for use with another refrigerant and oil type.

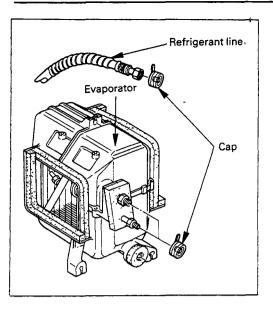
# R-134a Refrigerant:

- R-134a differs entirely from R-12 in its composition and, therefore, the two should never be mixed. Always change the specified amount of R-134a.
- The pressure characteristics of R-134a differ from those of R-12. The low pressure is lower, and the high pressure is higher.

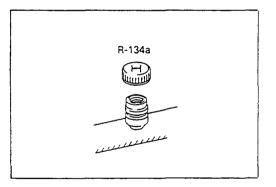
# R-134a Compressor oil:

- The R-134a system requires a synthetic (PAG) compressor oil whereas the R-12 system requires a mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

Oil Specification	RL 100S
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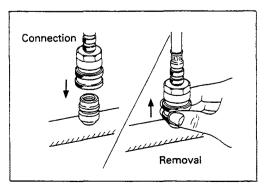


- The PAG compressor oil for the R-134a system tends to absorb moisture more quickly than mineral oil. When air conditioning parts are removed for servicing, all the open ends of parts and components must be sealed with caps to keep out contaminants.
- The PAG compressor oil must be stored in metal containers, not in plastic containers.



Service charge valve:

 The diameter of the service charge valve for the R-134a system is made larger than that for the R-12 system to prevent cross-contamination. In addition, the screw-in type joint of the R-12 system is replaced with a quick joint type in the R-134a system.



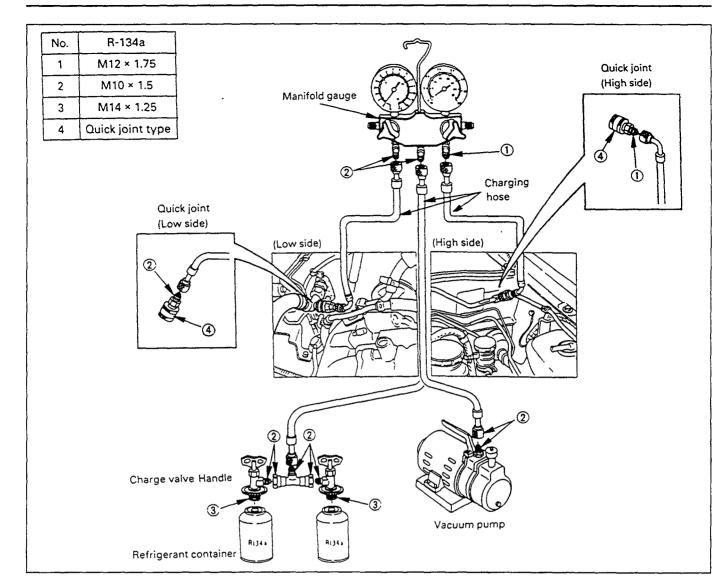
 To prevent refrigerant from escaping during installation and removal of charging hoses from the service charge valves, quick-joint type fittings are used.

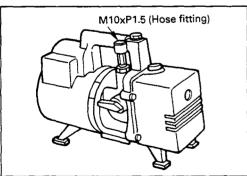
Connection: Push on firmly until locked (a "click" will be

heard).

Removal: Hold the grip-ring and pull to remove.

 Air conditioning manifold gauges, charging hoses and other service tools designed exclusively for the R-134a system must be used with this vehicle.



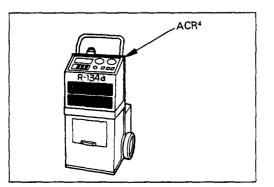


- Do not use the same vacuum pump for evacuating the R-134a and R-12 systems interchangeable (The vacuum pump hose fitting is a M10 x 1.5).
- R-134a vacuum pumps must have a positive shutoff valve.



### **CAUTION:**

Never use the same vacuum pump for both R-134a and R-12 systems, as cross contamination of compressor oil may occur.



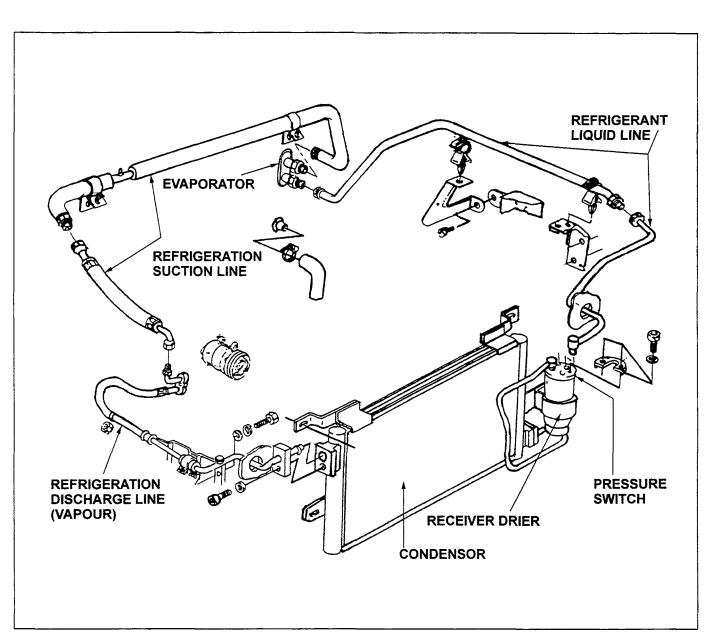


# Refrigerant Recovery, Recycling and Charging

Avoid releasing the R-134a into the atmosphere.
 Use the R-134a Refrigerant Recovery/Recycling/
 Recharging System or equivalent to recover and recycle
 R-134a. Note that this system is not interchangeable between the R-134a and R-12 systems.

# Refrigerant Leak Inspection

- The flame type gas leak detector for the R-12 system cannot be used with the R-134a system.
- The electric leak detector for the R-12 cannot be used with the R-134a system as the R-134a particles are far smaller than the R-12 molecules and, therefore, may not be always detected. Use leak detectors designed exclusively for the R-134a system.



# PRECAUTIONS FOR REPLACEMENT OT REPAIR OF R-134a AIR CONDITIONING PARTS

There are certain procedures, practices and precautions that should be followed when servicing air conditioning systems:

- · Keep your work area clean.
- Always wear safety goggle and protective gloves when working on refrigerant systems.
- Beware of the danger of carbon monoxide fumes caused by running the engine.
- Beware of discharged refrigerant in enclosed or improperly ventilated garages.
- Always disconnect the negative battery cable and discharge and recover the refrigerant whenever repairing the air conditioner system.
- When discharging and recovering the refrigerant, do not allow refrigerant to discharge too fast; it will draw compressor oil out of the system.
- Keep moisture and contaminants out of the system.
   When disconnecting or removing any lines or parts, use plugs or caps to close the fittings immediately. Never remove the caps or plugs until the lines or parts are reconnected or installed.
- When disconnecting or reconnecting the lines, use to wrenches to support the line fitting, to prevent from twisting or other damage.
- Always install new O-rings whenever a connection is disassembled.
- Before connecting any hoses or lines, apply new specified compressor oil to the O-rings.
- When removing and replacing any parts which require discharging the refrigerant circuit, the operations described in this section must be performed in the following sequence:

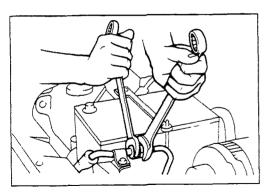
## FOREIGN MATERIAL IN THE SYSTEM

Whenever foreign material is sound in the system, it must be removed before restoring the system to operation. In the event of compressor mechanical failure, must perform the following operations:

#### NOTE:

Fasteners must be removed carefully to prevent the spillage of refrigerant oil.

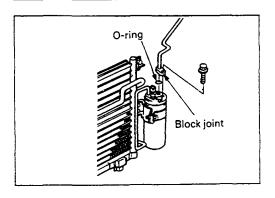
- 1. Remove the compressor.
- 2. Remove the receiver-dryer and discard the unit.
- 3. Flush the condensor to remove any foreign material which has been pumped into it.
- 4. Disconnect the refrigerant line from the condensor at the inlet connection of the expansion valve.
- 5. Inspect the refrigerant line for the presence of metal chips or other foreign material.
- 6. Flush any foreign material from the refrigerant line.
- 7. Reconnect the refrigerant line to the expansion tube.
- 8. Install the replacement compressor and the receiver dehydrator.
- 9. Add the necessary quantity of refrigerant oil to the system.
- 10. Evacuate, charge, and check the system.



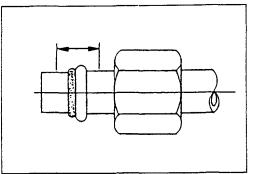
# REPAIR OF REFRIGERANT LEAKS

# **Refrigerant Line Connections**

Install new O-rings, if required. When disconnecting or connecting new lines, use two wrenches to prevent the connecting portion from twisting or becoming damaged.



When connecting the refrigerant line at the block joint, securely insert the projecting portion of the joint portion into the connecting hole on the unit side and secure with a bolt.



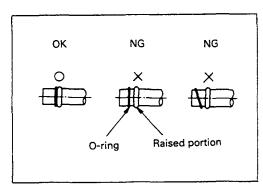


Apply specified compressor oil to the O-rings prior to connecting.

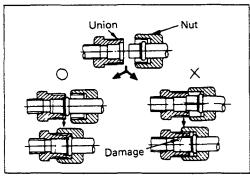


#### CAUTION:

Compressor (PAG) oil to be used varies according to compressor model. Be sure to apply oil specified for the model of compressor.



O-rings must be closely aligned with raised portion of refrigerant line.





Insert nut into union. First tighten nut by hand as much as possible. Then, tighten nut to specified torque.

(Refer to "Refrigeration System" on page 9 of this section).



## **LEAK AT REFRIGERANT LINE CONNECTIONS**

- 1. Check the torque on the refrigerant line fitting and, if too loose, tighten to the specified torque.
  - Use two wrenches to prevent twisting and damage to the line.
  - Do not over tighten.
- 2. Perform a leak test on the refrigerant line fitting.
- If the leak is still present, discharge and recover the refrigerant from the system.
- 4. Replace the O-rings.
  - O-rings cannot be reused. Always replace with new ones.
  - Be sure to apply to specified compressor oil to the new O-rings.
- 5. Retighten the refrigerant line fitting to the specified torque.
  - Use two wrenches to prevent twisting and damage to the line.
- 6. Evacuate, charge and retest the system.

# **LEAK IN THE HOSE**

If the compressor inlet or outlet hose is leaking, the entire hose must be replaced. Refrigerant hose must not be cut or spliced for repair:

- 1. Locate the leak.
- 2. Discharge and recover the refrigerant.
- 3. Remove the hose assembly.
  - · Cap the open connections at once.
- 4. Connect the new hose assembly.
  - Use two wrenches to prevent twisting or damage to the hose fitting.
  - Tighten the hose fitting to the specified torque.
- 5. Evacuate, charge and test the system.

## **COMPRESSOR LEAKS**

If the leaks are located around the compressor shaft seal or shell, replace the compressor.



### REPLACEMENT OF COMPONENT PARTS

When replacing system component parts, supply the following amount of oil to the component parts to be installed.

	CC	
Component parts to be installed	Amount of oil	
Evaporator	50	
Condenser	30	
Receiver/drier	30	
Refrigerant line (one piece)	10	



# RECOVERY, RECYCLING, EVACUATION AND CHARGING

## Handling Refrigerant-134a

Air conditioning systems contain R-134a. This is a chemical mixture which requires special handling

procedures to avoid personal injury. Always wear safety goggles and protective gloves.

- Always work in a well-ventilated area. Do not weld or steam
- clean on or near any vehicle-installed air conditioning lines or components. If R-134a should come in contact with any part of the body,
- flush the exposed area with cold water and immediately seek medical help. If it is necessary to transport or carry any container of
- R-134a in a vehicle, do not carry it in the passenger compartment. If it is necessary to fill a small R-134a container from a large one, never fill the container completely. Space should
- always be allowed above the liquid for expansion. • R-134a and R-12 should never be mixed as their

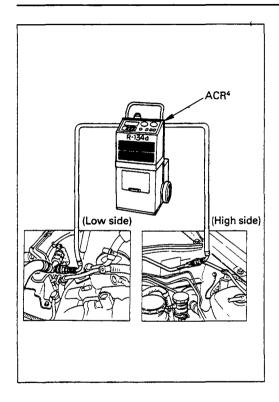
compositions are not the same.

- R-134a PAG oil tends to absorb moisture more quickly than R-12 mineral oil and, therefore, should be handled more carefully.
- Keep R-134a containers stored below 40°C (100°F).



# WARNING

- Should R-134a contact your eye(s), consult a doctor immediately.
  - Do not rub the affected eye(s). Instead, splash quantities of fresh cold water over the affected area to gradually raise the temperature of the refrigerant above the freezing point.
- Obtain proper medical treatment as soon as possible. Should the R-134a touch the skin, the injury must be treated the same as skin which has been frostbitten or frozen.





### REFRIGERANT RECOVERY

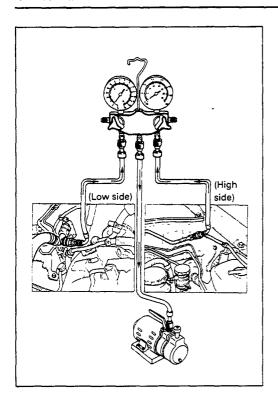
The refrigerant must be discharged and recovered by using the ACR4 (R-134a Refrigerant Recovery/ Recycling/ Recharging System) or equivalent before removing or installing air conditioning parts.

- Connect the high and low charging hoses of the ACR4 (or equivalent) as shown.
- 2. Recover the refrigerant by following the ACR4 Manufacturer's Instructions.
- When a part is removed, put a cap or a plug on the connecting position so that dust, dirt or moisture cannot get into it



#### REFRIGERANT RECYCLING

Recycle the refrigerant recovered by the ACR4 or equivalent. For the details of the actual operation, follow the steps in the ACR4 Manufacturer's Instructions.



# EVACUATING (DRAW VACUUM) THE AIR-CON SYSTEM AND RECYCLING REFRIGERANT

Open both blue (liquid) and red (vapour) valves on tank and switch machine on. Programme the vacuum time to 30 mins, press enter. Open both red (high side) and blue (low side) valves on the control panel. Press button marked "Vacuum" to start evacuating the A/C system. The digital display counts down the remaining evacuation time in minutes and seconds.

#### NOTE:

If "Oil" flashes on the display, maintenance must be called to change the vacuum pump oil.

### NOTE:

If code U-H1 is on digital display, there is high pressure to the vacuum pump. Remove charging hoses from the vehicle and press "Recover" to recover all the gas in the hoses. Draw vacuum for 5 mins and press "Hold/ Continue". Both gauges should hold the vacuum for at least 2-5mins.

#### NOTE:

If gauges rise there is a leak. Refer to Leak Test Proceed.

# PRESSURE TEST THE SYSTEM BY USING NITROGEN AND REPAIR THE LEAK

If both gauges hold vacuum for the 2-5mins, press "Hold/ Continue" to continue to draw vacuum on the system. The vacuum sequence continues for the remaining programmed length of time. (the display counts the time down to zero mins). The digital display shows the message "CPL" to indicate that evacuation is complete.

Whilst the vacuum pump is running, the recycling process begins automatically, 5 secs after the vacuum pump starts. The "Recycle" message illuminates to indicate the unit is recycling the refrigerant to the tank.

## NOTE:

If the moisture indicator is green, you may use the refrigerant. If the moisture indicator is yellow on completion of recycling, the filter-drier is saturated.

Maintenance must be called to replace the filter.



## CHARGING THE REFRIGERANT SYSTEM

There are various methods of charging refrigerant into the air conditioning system. These include using the ACR4 (R-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent and direct charging with a manifold gauge charging system.

ACR4 (115V 60Hz): 5-8840-0629-0 (J-39500-A)

ACR4 (220-240V 50/60Hz): 5-8840-0630-0 (J-39500-220A)

ACR<sup>4</sup> (220-240V 50/60Hz Australian model): 5-8840-0631-0 (J-39500-220ANZ)

# Charging procedure

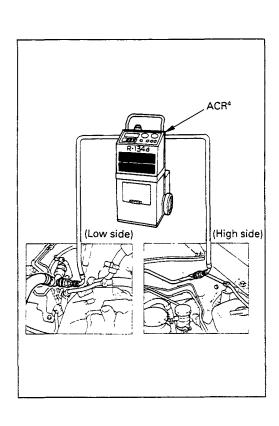
- ACR<sup>4</sup> (or equivalent) method
- 1. Open both blue (liquid) and red (vapour) valves on tank and switch machine on.
- Unscrew suction caps on compressor: connect red (high pressure) hose to discharge valve (marked D) and blue (low pressure) hose to suction valve (marked S).
- 3. At vacuum time amount, press "Shift/Reset" and set charge amount to 0.75 kg. Press "Enter".
- 4. Open both valves on the units control panel.
- 5. Press the "Chg" key on the key pad. The digital display shows the message "Automatic" and the amount of refrigerant programmed.

### NOTE:

You will hear the solenoid open & the display will count down to zero.

The message "Cpl" displays when charging is completed.

 If the refrigerant transfer is too slow, the unit will beep. If the display does not show the message "Check Refrigerant", close the high side valve and start the A/C system to pull the remainder of the charge onto the system.



7. If the charge will not completely transfer and the display shows the message "Check Refrigerant", press the "Hold/Cont" key to interrupt the cycle then press "Reset".

8. The refrigerant in the air con. system must then be

return to step 1of the "Charge the System".

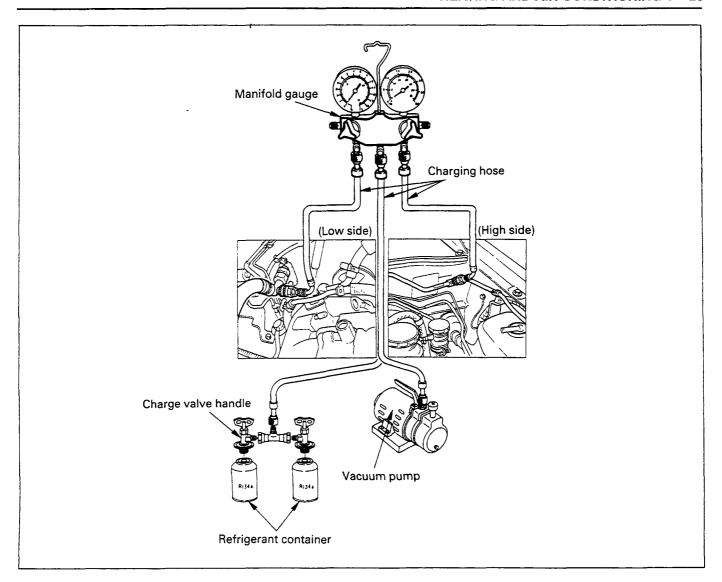
- recovered using the Recover Refrigerant instructions. 9. New refrigerant must be added to the tank using the "Adding Refrigerant to the Tank". Once tank is filled,
- 10. Close both high and low side gauges on the control panel.
- 11. Start the vehicle. Switch on the air con. Ensure that the air control levers are on "Recirculate": Fan speed on maximum and the centre vents are open.
- stabilise (compare the readings to the system operating specifications).

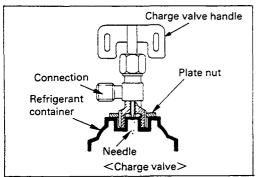
12. Le the system run until the gauge pressure readings

- 13. Switch off the vehicle. Check all connections with a refrigerant leak detector.
- 14. If a leak is present, recover the refrigerant in the system and repair the leak.

### NOTE:

The amount of oil recovered in the oil catch bottle (during the evacuation process) has to be returned into the system before charging.





# Direct charging with a manifold gauge charging station method

Handling the charge valve handle when installing refrigerant container.

- 1) Before attaching the charge valve to the refrigerant container, turn the charge valve handle counterclockwise until the needle is fully retracted.
- 2) Turn the plate nut counterclockwise until it reaches its highest position relative to the charge valve.
- 3) Install the charge valve onto the refrigerant container.
- 4) Turn the plate nut clockwise and connect the center hose of the manifold gauge to the charge valve.
- 5) Tighten the plate nut sufficiently by hand. Then turn the charge valve handle clockwise to lower the needle and bore a hole in the refrigerant container.
- 6) Turn the charge valve handle counterclockwise to raise the needle. The refrigerant in the refrigerant container is charged into the air conditioning system by the operation of the manifold gauge.
  - Be absolutely sure not to reuse the emptied refrigerant container.

- 1. Make sure the evacuation process is correctly completed.
- Connect the centre-hose of the manifold gauge to the refrigerant container.
  - Turn the charge valve handle counterclockwise to purge the charging line and purge any air exiting in the centre-hose of the manifold gauge.
- Open the low-pressure hand valve and charge the refrigerant about 200g (0.44 lbs).
  - Make sure the high-pressure hand valve is closed.Avoid charging the refrigerant by turning the refrigerant
- container upside down.4. Close the low-pressure hand valve of the manifold gauge.
  - Check to ensure that the degree of pressure does not change.
- Check the refrigerant leaks by using a R-134a leak detector.
  - If a leak occurs, repair the leak connection, and start all over again from the first step of evacuation.
- If no leaks are found, open the low-pressure hand valve of the manifold gauge. Then continue charging refrigerant of the system.
  - · When charging the system becomes difficult:
  - 1. Run the engine at 1,300~1,500 rpm and open all the vehicle doors.
  - 2. A/C switch is "ON".
  - Set the fan control knob (fan switch) to its highest position.



# **WARNING:**

Be absolutely sure not to open the high-pressure hand valve. Should the high-pressure hand valve be opened, the high-pressured refrigerant gas would flow backward, and this may cause the refrigerant container to burst.

- When the refrigerant container is emptied, use the following procedure to replace it with a new refrigerant container.
  - Close the low-pressure hand valve.
  - Raise the needle upward and remove the charge valve.
  - 3. Reinstall the charge valve to the new refrigerant container.
  - 4. Purge any air existing in the centre hose of the manifold gauge.
- 8. Charge the system to the specified amount and then close the low-pressure hand valve.

# Refrigerant Specified Amount

a

### 750

- Check the high and low pressure valve of the manifold gauge.
- Check for refrigerant leaks by using a R-134a leak detector.

### 1 - 26 HEATING AND AIR CONDITIONING

Immediately after charging refrigerant, both high and low pressures are slightly high and to the left of the gauge, but they settle down to the guide pressure valves as shown below:

- Ambient temperature; 30~35°C (86~95°F)
- · Guide pressure

High pressure side;

Approx. 1373~1667 kPa (14~17 kg·cm²/199~242 PSI)

Low pressure side;

Approx. 127~245 kPa (1.3~2.5 kg·cm²/18~36 PSI)

- 9. Close the low pressure hand valve and charge valve of the refrigerant container.
- 10. Stop the air conditioning and the engine.
- 11. Disconnect the high and low pressure hoses from the manifold gauge fittings.

Pipe diameter	Screw size	Pipe material	Closing torque;
			N.m)
8 mm (0.31 in)	M16 x 1.5	Aluminium tube	(0-20)
12 mm(0.47 in)	M20 x 1.5	Aluminium tube	(5-25)
16 mm (0.63 in)	M22 x 1.5	Aluminium tube	(20-29)

### NOTE:

If steel to aliminimum connections are being made, use the torque values for aluminimum.

### REFRIGERANT HOSE FAILURE

After a leak or rupture has occurred in a refrigerant hose, or if a fitting has loosened and caused a considerable loss of refrigerant and oil, the entire system should be flushed and recharged after repairs have been made.

If the system has been opened to atmosphere for any prolonged period of time, the receiver-dryer should be replaced.

### **GENERAL NOTES**

- A small amount of refrigerant oil must be applied to all "O" rings and fittings.
- Cleanliness in storage and handling of all aircon components is vital to good aircon performance.
- Sealing caps on the various components should not be removed until immediately before fitment.
- Torques on all hose fittings are extremely important.
   Over or under tightening will cause leaks, if not immediately, then later in the field.

The PAG compressor oil for the R-134a system needs to absorb moisture more quickly than mineral oil. When air conditioning parts are removed for servicing, all the open end of parts and components must be sealed with caps to keep out contaminants.

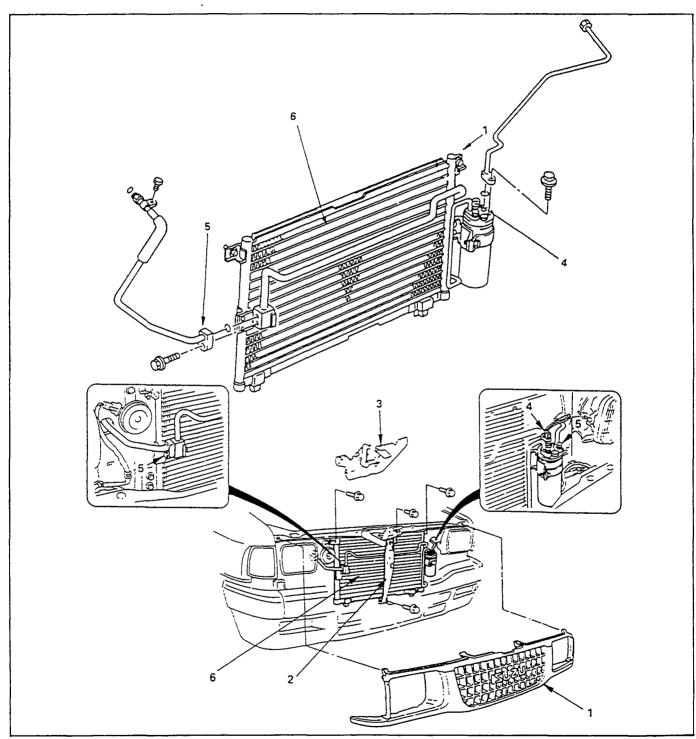
The PAG compressor oil must be stored in metal containers, not in plastic containers.

# **CONDENSER**





# **REMOVAL AND INSTALLATION**



# **Removal Steps**

- 1. Radiator grille
- 2. Engine hood front end stay
- 3. Engine hood lock
- 4. Pressure switch connector
- 5. Refrigerant line
- 6. Condenser

# **Installation Steps**

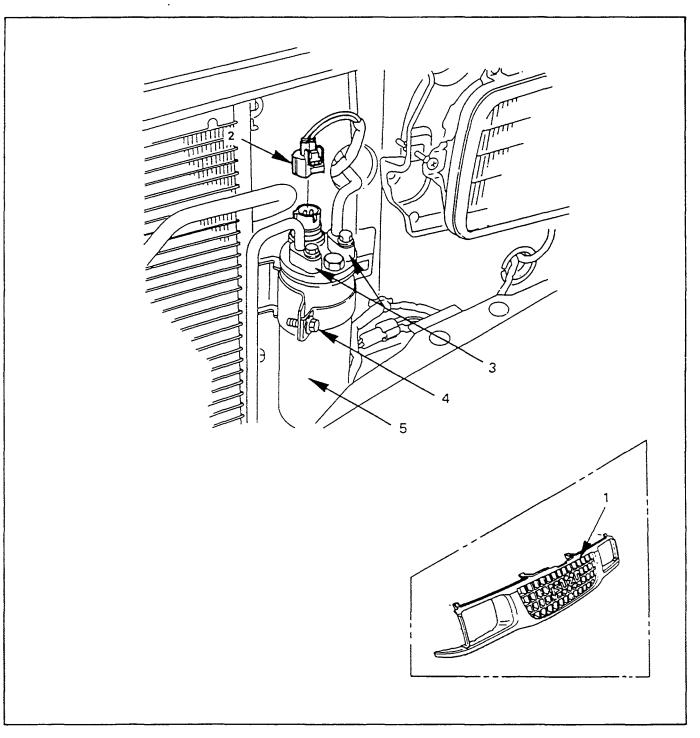
To install, follow the removal procedure in reverse order.

# RECEIVER DEHYDRATOR





# **REMOVAL AND INSTALLATION**



# **Removal Steps**

- 1. Radiator grille
- 2. Dual pressure switch connector
- 3. Refrigerant line
- 4. Bracket bolt
- 5. Receiver dehydrator

# **Installation Steps**

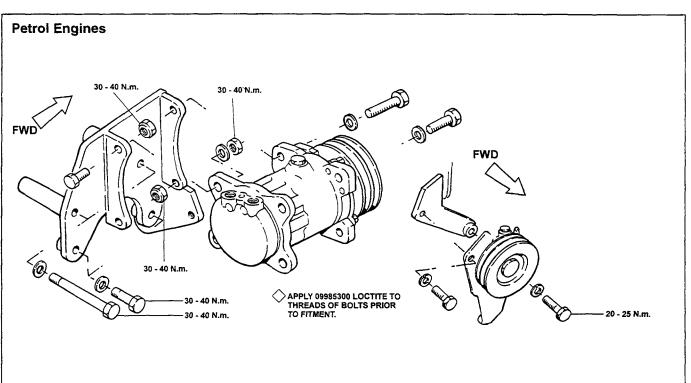
To install, follow the removal procedure in reverse order.

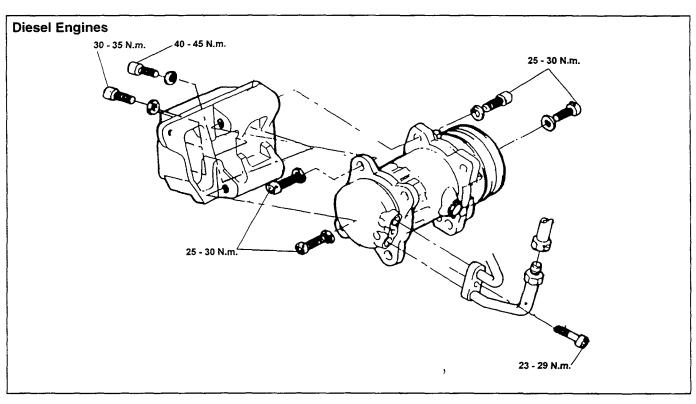
# **COMPRESSOR**

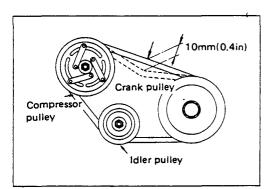




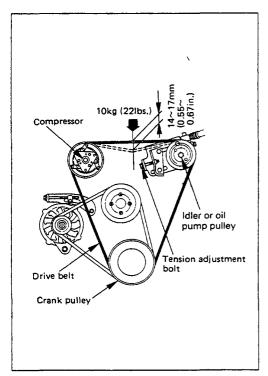
# **REMOVAL AND INSTALLATION**







# Petrol Engine



# Diesel Engine



# 3. Compressor Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb/98 N) force.

Petrol Engine

Standard deflection mm(in.) 10 (0.4)				
	Standard deflection	mm(in.)_	10 (0.4)	

4J Engine

Standard deflection	mm(in.)	14 - 17
		(0.55 - 0.67)

# **GENERAL REPAIR PROCEDURE**

# Oil Specification:

- The R-134a system requires a synthetic (PAG) compressor oil whereas the R-12 system requires
- mineral compressor oil. The two oils must never be mixed. · Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

# Specified Compressor Oil

**RL 100S** 

# **Contamination of Compressor Oil:** Unlike engine oil, no cleaning agent is added to the

period of time (approximately 1 season), the oil never becomes contaminated as long is there is nothing wrong with the compressor or its method of use.

# tions:

- The capacity of the oil has increased.
- The oil has changed colour to red.
- Foreign substances, metal powder, etc., are present in the oil.

Inspect the extracted oil for any of the following condi-

compressor oil. Even if the compressor runs for a long

If any of these conditions exist, compressor oil is contaminated. Whenever contaminated compressor oil is discovered, the receiver/drier must be replaced.

## Handling of Oil:

- The oil should be free of moisture, dust, metal powder, etc.
- Do not mix with other oil.
- The water content in the oil increases when exposed to the air. After use, seal oil from air immediately.
   (R-134a PAG Compressor Oil absorbs moisture much easier than R-12)
- The compressor oil must be stored in steel containers, not in plastic containers.

## **Compressor Oil Check:**

The Oil used to lubricate the compressor is circulating with the refrigerant.

Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

## Oil capacity

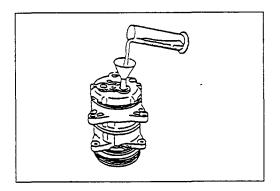
Sanden SD 7H13 135cc (± 15cc)

# Oil Return Operation:

There is a close affinity between the oil and the refrigerant. During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

- 1. Open the doors and engine hood.
- 2. Start the engine and A/C switch is "ON" and set the fan control knob at its highest position.
- Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
- 4. Stop the engine.

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# **Replacement of Component Parts:**

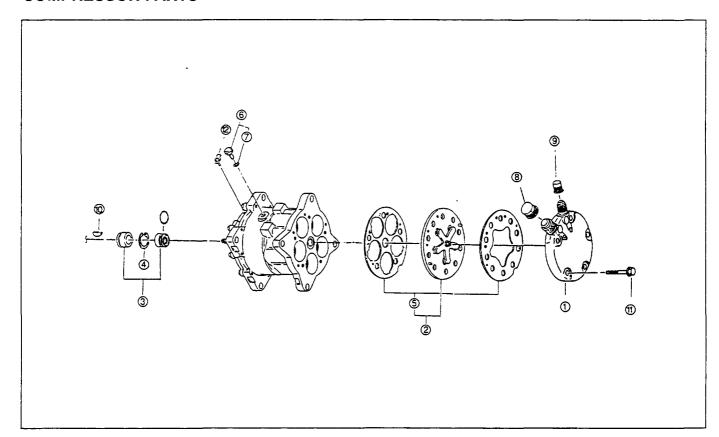
When replacing system component parts, supply the following amount of oil to the component parts to be installed.

Component parts to be installed	Amount of oil
Evaporator	50 cc
Condenser	30 cc
Receiver/drier	30 cc
Refrigerant line (One piece)	10 cc

Refrigeration oil must be replenished if more than two parts are removed at the same time. After installing these components, check compressor oil.

1

# **COMPRESSOR PARTS**



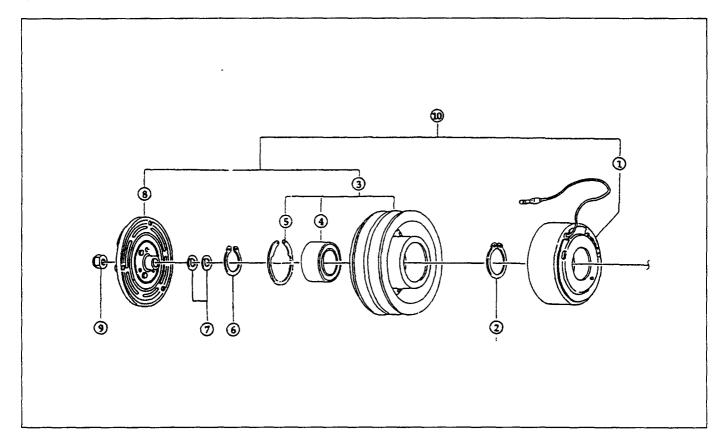
# **Description**

- 1. Cylinder Head
- 2. Valve Plate Assembly
- 3. Seal Kit with Felt Ring Assembly
- 4. Seal Snap Ring
- 5. Cylinder Block and Head Gasket
- 6. Oil Plug with "O" Ring

- 7. Sealing "O" Ring
- 8. Suction Port Cap
- 9. Discharge Port Cap
- 10. Shaft Key
- 11. Cylinder Head Bolt
- 12. Lead Wire Screw Clamp

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# **CLUTCH PARTS**



# Description

- 1. Core Assembly
- 2. Core Snap Ring
- 3. Rotor Assembly
- 4. Clutch Bearing
- 5. Rotor Snap Ring

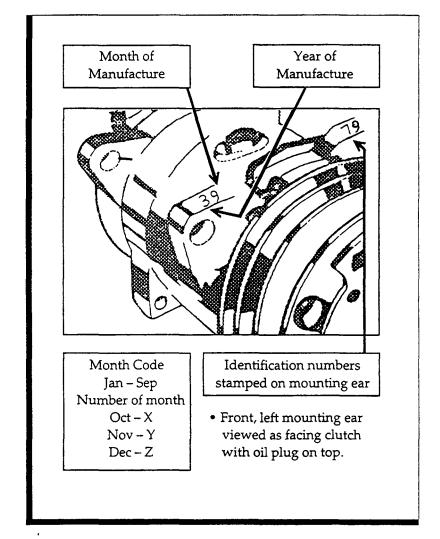
- 6. Front Housing Hub Snap Ring
- 7. Shims
- 8. Armature Assembly
- 9. U-nut
- 10. Clutch Assembly

# **HEATING AND AIR CONDITIONING 1 – 37**

Torque Specifications	Do not exceed upper limits
ltem ·	N.m
U-nut	15-21
Oil filler Plug	13-15
Cylinder Head Bolt	33-35
Discharge Hose 3/4	25-29
- 16 UNF inch Flare Nut	
Suction Hose 7/8	34-44
- 14 UNF inch Flare Nut	
Drive Belt (New)	135
Drive Belt (Run-in)	108-123
Clutch Wire Clamp Screw	2-2.4

# **COMPRESSOR IDENTIFICATION**

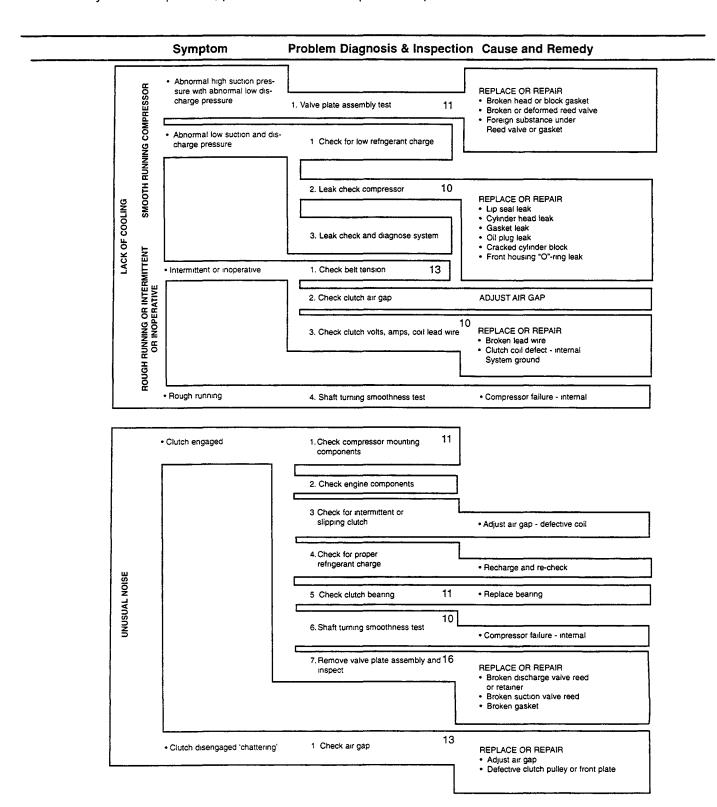




# **SERVICE PROCEDURES**

## TROUBLE SHOOTING CHART

This chart refers specifically to the SANDEN compressor. During diagnosis follow the inspection procedures in the sequence shown until a defect is found. Then perform the repair in the Cause and Remedy Section. If this repair does not fully solve the problem, proceed to the next inspection step.



# **INSPECTION PROCEDURES**

Listed below are the various inspection procedures which are very useful for easy systematic tracing of faults.

### **LEAK CHECK**

#### Visual:

Seeping of oil does not necessarily indicate leakage of refrigerant. You can look at the following problems:-

## Repairable:

- · Oil at lip seal area (feel at seal cavity).
- Oil around cylinder head (feel at gasket, fittings).
- Oil around oil plug (oil plug "O"-ring is damaged).

## Non Repairable:

- · Oil at cracks in cylinder block, front housing.
- Oil around oil plug (where cylinder block thread is damaged).

### **GENERAL**

Always clean away all oil, grease and dirt, etc. and blow away residual refrigerant before commencing any inspection.

There are many ways of detecting leakage.

The most commonly use is the "Soap Bubble" method. Pressurise the compressor and apply soap solution on all parts of the compressor - any bubble evolves out indicates a leak.

# **Shaft Turning Smoothness Test Brand New Compressor:**

- 1. Place the compressor with the oil plug facing upwards.
- 2. Uncap suction and discharge port cover cap.
- With a 14 mm socket and a torque wrench (10-150 kg cm), rotate the compressor shaft nut. If severe resistance or 'catches' are felt during rotation, replace the compressor.
- 4. Compressor is ready for installation into vehicle.

### **HEATING AND AIR CONDITIONING 1 – 41**

## installed Compressor:

- 1. Release gas.
- 2. Disconnect the suction and discharge hoses.
- 3. Disengage the clutch.
- 4. Rotate compressor shaft with a 14 mm socket and a torque wrench on the shaft nut.
- If severe resistance or 'catches' are felt during rotation, replace the compressor.

### **CLUTCH TEST**

- 1. Replace the core assembly if the coil wire is broken (see Clutch Service Section).
- 2. Check on amperage and voltage, the current range is from 3.2A to 4.2A at 12V.
  - A very high current reading indicates a short circuit within the core wire.
  - (ii) No current reading indicates an open circuit.
  - (iii) An intermittent or poor system ground will result in a lower voltage at clutch (check for proper sitting of core snap ring or loosen lead wire clamp screw).
  - (iv) Replace the core assembly if there is open or short circuit.
- Check on air gap (0.4 mm 0.8 mm) with a feeler gauge. Incorrect air gap may result in malfunction during engagement and disengagement on clutch (see Clutch Service Section).
- 4. If there is suspected bearing noise, remove belt and disengage clutch, listen for bearing noise by rotating rotor assembly with hand. The rotor assembly must be replaced if there is excessive noise.

#### **UNUSUAL NOISE**

#### **Compressor Mounting Components:**

#### Check for:-

- Loose belt (Torque up to specifications).
- Broken bracket and/or compressor mounting ear. (Replace broken components).
- Missing, broken or loose bolts at compressor and engine fixing points.
- Flush fit at all points.
   (Replace any bracket component not fitting properly.
   Torque bolts to engine using manufacturer's specifications).
- Loose or wobbling crankshaft pulley, incorrect centre bolt torque or centre bolt 'bottoming'. (repair to manufacturer's specifications).
- Rough idle pulley bearing. (Replace if necessary).

#### **Engine Components Noise:**

#### Check for noise in:-

- Alternator bearing.
- Air pump (if any).
- Water pump bearing.
- Engine valves.
- Timing mechanism.
- Loose engine mounting bolts.

#### Regrigerant Charge:

A 0 - 35 bar or lower suction pressure due to a low refrigerant charge can cause unusual noise (Restore refrigerant to proper level).

Re-test by applying heat to evaporator for higher suction pressure.

#### Clutch Bearing:

(see Clutch Test)

#### Valve Noise:

Check for a broken or distorted reed valve or broken gasket.

#### VALVE PLATE ASSEMBLY TEST

Valve plate assembly failures (suction or discharge valve or gasket) may be determined with the compressor installed on the car.

#### Discharge or Suction Valve Breakage:

 when compressor is operated at idle speed, compressor makes a 'clacking' sound.

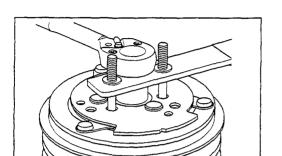
#### **Head Gasket Breakage:**

 at idle speed, discharge pressure does not increase to normal condition and suction pressure is high.

Checking the discharge valve and head gasket by pressure balancing test:-

- Connect manifold gauge set to suction and discharge ports.
- Run compressor for five minutes at idling speed and stop.
- Measure elapsed time for discharge and suction pressure to equalise. If less than two minutes, discharge valve or head gasket is broken.

#### **REPAIR PROCEDURES**

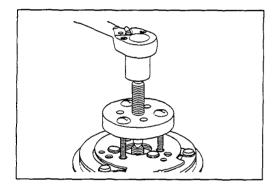


#### **CLUTCH SERVICE**

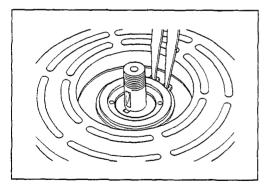
The clutches for all models include a visible counterweight on the front plate to improve dynamic balance.

#### Steps for Clutch Removal:

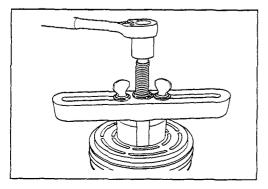
 Place the three pins front plate holder into the holes of the front plate and remove the U-nut with a 14 mm socket. The U-nut cannot be re-used.



Remove the armature assembly by using the armature extractor. Fix the bolts into the threaded holes and while holding the extractor plate still, rotate the handle clockwise until the armature assembly is taken out.



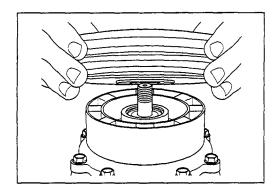
3. Remove the front housing hub snap ring with an external snap ring plier.

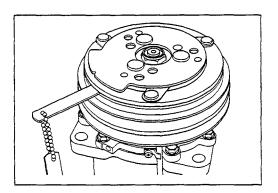


4. Insert the lip of the rotor extractor into the rotor snap ring groove and tighten the 2 wing nuts. Turn the centre bolt until the rotor assembly is free.

## HEATING AND AIR CONDITIONING 1 – 45

Loosen the lead wire clamp screw with a cross screw driver and with an external plier, remove the core snap ring and take out the core assembly.





#### Steps for Clutch Installation:

Clutch installation procedure is the reverse of clutch removal.

- Install core assembly. Insert core assembly onto front housing hub with the core protrusion sitting corresponding into the hole of the front housing. With an external plier, fix back the core snap ring.
- Tighten lead wire clamp screw to the specification given.
- 3. Install rotor assembly. Fix rotor assembly back with a rotor installer by using a press.
  Another alternative is to use a hammer and tap lightly on the rotor installer until the rotor assembly sits into the front housing hub. Listen for a distinct change of sound when the rotor rests fully onto the hub.
- 4. Re-install the front housing hub snap ring (flat side facing down) with an external snap ring plier.
- Install armature assembly. With an armature press-in jig
  and ensuring the front plate keyway is aligned with the
  compressor shaft key, fix in the armature assembly by
  a hammer or with a hand press.
- With a new U-nut, torque up according to specification by using a front plate holder and a torque wrench with a 14 mm socket.
- 7. Check for air cap. With a feeler gauge of 0.4 mm and 0.8 mm, insert gauge into gap. Feeler gauge of 0.4 mm must be able to be inserted into the whole circumference whereas feeler gauge of 0.8 mm must not be inserted at any point. If gap is too big, lightly tap with a mallet on the front plate at the high spots. If gap is too small, use a flat screw to raise up the front plate of the low spots.

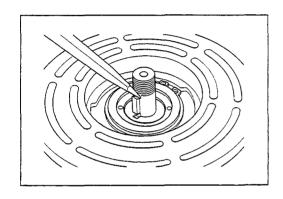
#### NB:

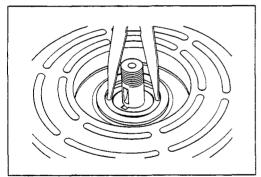
The air gap is determined by the spacer shims. When installing the clutch assembly, try the original shims first. If the air gap does not meet the specifications in Step 7, add or subtract shims (from accessory pack) by repeating Step 5 & 6.

#### LIP SEAL SERVICE

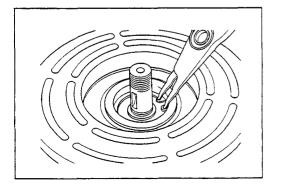
#### Step for Lip Seal Removal:

- 1. Repeat Step 1 5 in Clutch Removal Section.
- 2. Remove the shims by hand.
- 3. Remove shaft key by lightly tapping it loose with a flat screw driver and hammer.





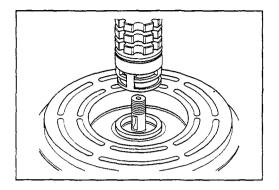




Removal of felt ring assembly. Lift up the felt ring assembly with an external snap ring plier.

5. Remove seal snap ring with an internal snap ring plier.

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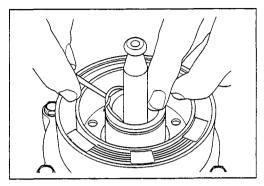


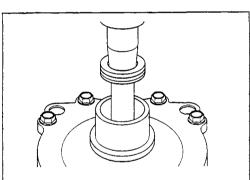
6. Remove lip seal with a seal extractor.

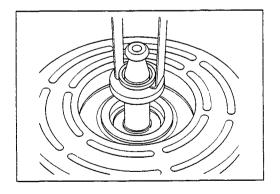
,

#### Steps for Lip Seal Installation:

- 1. Clean the sealing cavity thoroughly with an air gun.
- 2. Coat new lip seal with refrigerant oil. Never re-use the lip seal after removal.
- 3. Insert seal protector onto compressor shaft.

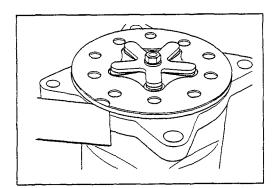






- With the lip seal attached to the lip seal installer, place
  the seal installer over the seal protector.
  Press in gradually until you can feel that the lip seal sits
  onto the base firmly.
- 5. With an internal snap ring plier, install the seal ring with the flat side facing downwards. Press in the snap ring with the snap ring installer. Another alternative is to lightly tap it with a flat screw driver.
- 6. Fix in the new felt ring assembly with the felt ring installer.

Install the shaft key with a flat plier. Ensure that it sits
properly inside the shaft keyway. Install the shims onto
the shaft. Reassemble the clutch onto compressor
following the procedures in "Steps for Clutch
Installation".



#### CYLINDER HEAD SERVICE

## Steps for Cylinder Head and Valve Plate Assembly Removal:

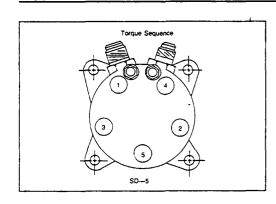
- 1. Visually inspect the cylinder head for fitting or thread damage.
- 2. Remove the 5 cylinder head bolts with a 13 mm socket.
- With a hammer and scraper, tap on the joint between cylinder head and valve plate assembly at the outer edge to remove the cylinder head.

4. Tap on the joint between valve plate assembly and cylinder block to remove valve plate assembly.

# Steps for Installation of Cylinder Head and Valve Plate Assembly:

- Install new/old valve plate assembly and cylinder block.
   Never re-use the old gaskets.
  - The 2 locating pins on valve plate ensure a foolproof installation.
- 2. Install cylinder head and hand tighten bolts.

#### **HEATING AND AIR CONDITIONING 1 – 51**



 Torque up to the specification using the "star" configuration.

#### **GENERAL INFORMATION**

#### REPLACING COMPRESSOR

When replacing the old compressor with a new one, follow this procedure closely:-

- Drain oil from old compressor and measure the amount.
- Drain oil from new compressor and refill in the correct amount to that of the old compressor. Never expose the oil to the atmosphere for too long.

In order to achieve high performance of compressor, sufficient amount of refrigerant oil is necessary. Excessive oil decrease cooling efficiency.

#### **INSTALLATION TIPS**

Trouble-free operation of SANDEN compressor depends on the below factors:-

- 1. Correct pulley alignment and belt size.
- 2. Correct torque of the drive belt.
- 3. Correct torque of all securing bolts and nuts.
- 4. Accurate and firm fitting of the compressor mounting bracket to compressor mounting and engine.
- 5. Sufficient refrigerant.
- Never operate the compressor with insufficient refrigerant oil at a high speed or prolonged period.

#### SPECIAL APPLICATIONS

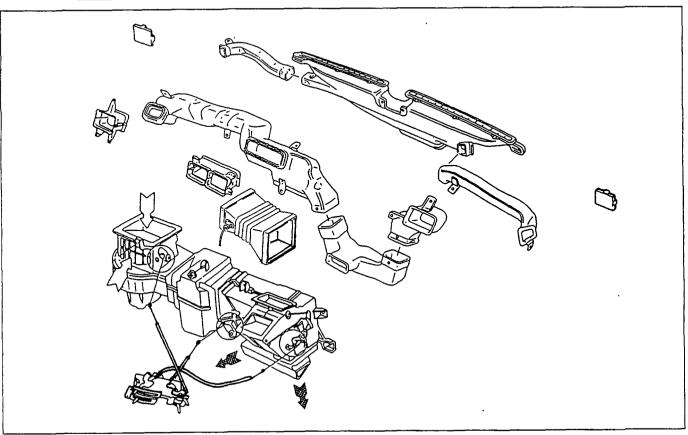
For discharge refrigerant hose which extends 4.5 m in length, an additional oil amount of 30 cc is to be added for every additional 2.0 m of hose length.

# HEATER UNIT, BLOWER UNIT AND EVAPORATOR ASSEMBLY





#### REMOVAL AND INSTALLATION



#### **Removal Steps**

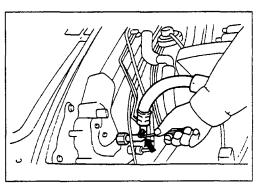
- \* Before evaporator assembly and heater unit removal, refer to section 2D "BODY" for instrument panel removal procedure.
- ▲ 1. Flare nut, evaporator to compressor and receiver tank
- ▲ 2. Connectors
  - 3. 3 nuts, evaporator
  - Evaporator assembly (if so equipped)
  - 4a. Duct, blower unit to heater unit (without evaporator model)
- ▲ 5. Hose, heater
- ▲ 6. Hose, heater
  - 7. Duct, side ventilator
  - 8. 4 nuts, heater unit
  - 9. Heater unit assembly
  - 10. Nuts and bolts, blower unit
- ▲ 11. Blower unit assembly

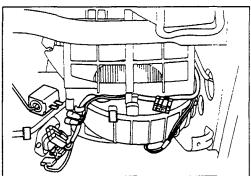
#### Installation Steps

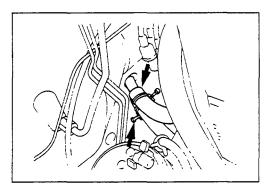
To install, follow the removal procedure in reverse order.

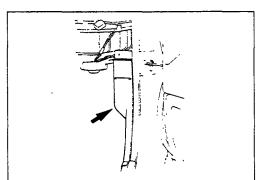
- ▲ 11. Blower unit assembly
  - 10. Nuts and bolts, blower unit
- ♠ 9. Heater unit assembly
  - 8. 4 nuts, heater unit
  - 7. Duct, side ventilator
- 6. Hose, heater
- ▲ 5. Hose, heater
  - 4a. Duct, blower unit to heater unit (without evaporator model)
  - 4. Evaporator assembly (if so equipped)
  - 3. 3 nut, evaporator
  - 2. Connectors
- 1. Flare nut, evaporator to compressor and receiver tank
- \* After evaporator assembly and heater unit installation, refer to section 2D "BODY" for instrument panel installation procedure.

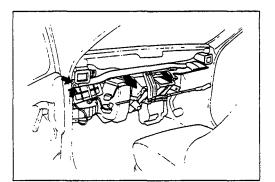
#### 1 - 54 HEATING AND AIR CONDITIONING











#### **Important Operations - Removal**

#### 1. Flare Nut

Before unscrewing the flare nut, leak out the refrigerant gas by depressing the expansion valve with screwdriver.

#### 2. Connectors

Write down the harness connection positions before disconnecting.

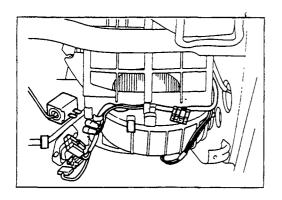
#### 5. and 6. Hose, heater

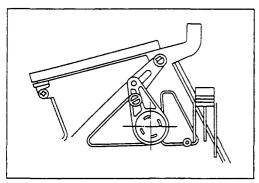
Since the coolant water flows out from hoses, place a drain pan under the vehicle before disconnecting hoses.

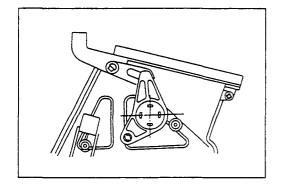
#### 11. Blower unit assembly

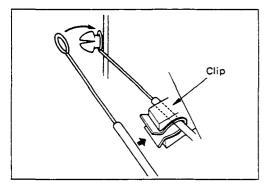
Remove the cover of seat belt warning buzzer first.

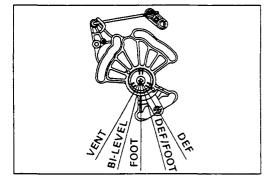
Unscrew the arrowed bolts and remove the blower unit with pulling the cross beam horizontally.











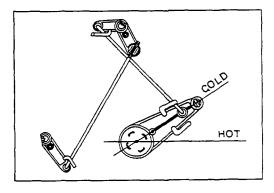
#### **Important Operations - Installation**

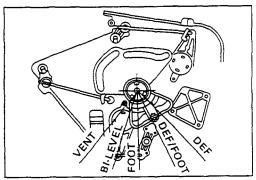
#### 11. Blower unit assembly

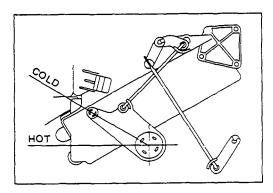
Pull out the harness fully before installation of blower unit assembly.

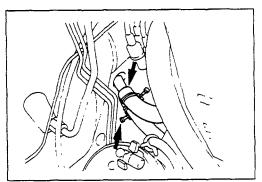
Connect the cable with the air-source select lever and blower assembly lever set in the CIRC position. Secure the outer tube with cable clip.

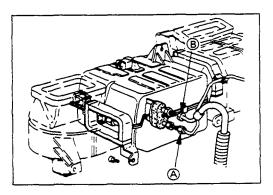
9. Heater unit assembly











#### Mode and temp cable:

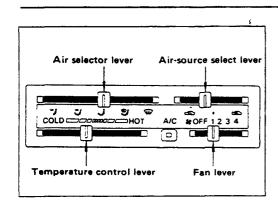
- 1. Attach the control assembly to the instrument panel using screws.
- Connect the cable, with the mode selector lever and heater assembly lever set in the DEF position. Secure the outer tube with cable clip.
- 3. Connect the cable with the temperature lever and heater lever set in the COLD position, then fix the outer tube with a cable clip. Check all doors and the water valve. If the doors are not closing properly, remove the cable and adjust the cable length as required.
- Defroster door the defroster door should be in the defroster position when the control lever is moved to the DEF and DEF/FOOT positions. Air is directed to the defroster outlets.
- Heat door in the positions of FOOT, DEF/FOOT and BI-LEVEL air is directed out to the centre and side outlets. Air is not delivered in other positions. However, when the heater is in use, some air is directed to the defroster.
- Vent door in the position of VENT (FACE) and BI-LEVEL, air is directed out to the centre and side outlets. Air is not delivered to any other position.
- Air mix door when the temperature control lever is in the HOT position, hot air is delivered. In COLD position, non-heated air is delivered.

#### 5. and 6. Hose, heater

After installation, replenishment of coolant water should be done to bring the coolant level of the radiator surge tank up to the "MAX" line.

#### 1. Flare nut, evaporator to compressor and receiver tank

	,	N•m
To compressor A	20 – 29	
To receiver tank B	10 – 20	

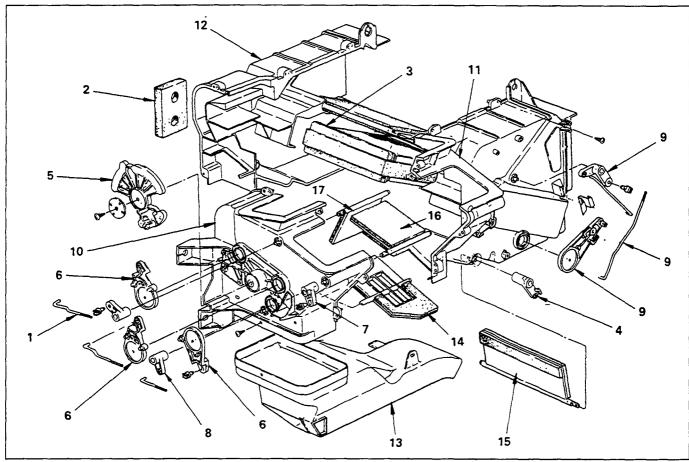


#### NOTE:

FAN SWITCH (CONTROL LEVERS)
OPERATING TIPS REFER TO "OWNER'S MANUAL".

#### **DISASSEMBLY AND ASSEMBLY**

#### **HEATER UNIT**



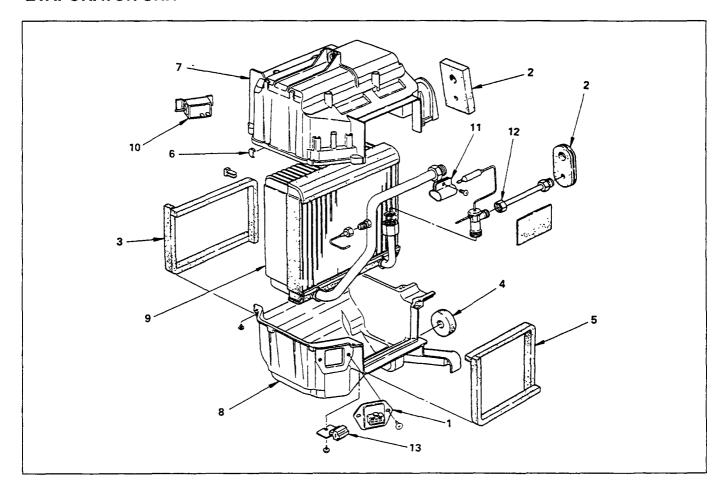
#### **Disassembly Steps**

- 1. Rod and lever, defroster door
- 2 Plate and seal
- 3. Core assembly
- 4. Lever, mix door
- 5. Link, main mode control
- 6. Relay link
- 7. Lever, vent door
- 8. Lever, heater door
- 9. Relay link mix door
- 10. Case, LH
- 11. Case, RH
- 12. Case, back
- 13. Duct
- 14. Door, heat foot
- 15. Door, heat mix
- 16. Door, side vent
- 17. Door, defroster

#### **Reassemble Steps**

To reassemble follow the disassembly procedure in reverse order.

#### **EVAPORATOR UNIT**

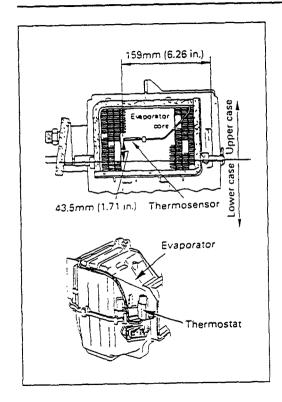


#### **Disassembly Steps**

- 1. Resistor; air-conditioning
- 2. Seal; vacuum
- 3. Seal
- 4. Seal
- 5. Seal
- 6. Attaching parts
- 7. Case; upper
- 8. Case; lower
- 9. Core assembly
- 10. Switch; thermostat
- 11. Clip; sensing tube
- 12. Expansion valve assembly
- 13. Diode

#### **Reassemble Steps**

To reassemble follow the disassembly procedure in reverse order.

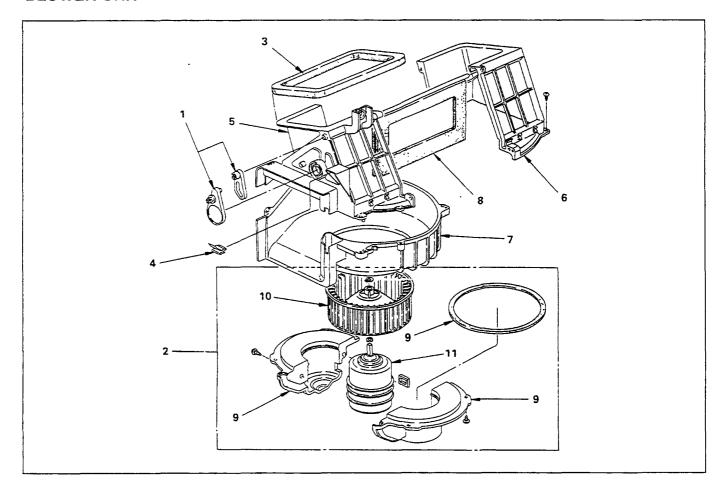




#### Important Operation - Reassembly

- 2. Thermostat (Clip type)
- Install the thermostat to the evaporator core specified position with the clip.
- 2. Thermostat sensor must not interfere with the evaporator core.

#### **BLOWER UNIT**



#### **Disassembly Steps**

- 1. Lever; door
- 2. Blower motor assembly
- 3. Seal
- 4. Attaching parts
- 5. Case; LH
- 6. Case; RH
- 7. Case; lower
- 8. Door; blower unit
- 9. Core; blower unit
- 10. Fan; blower motor
- 11. Blower motor

#### Reassemble Steps

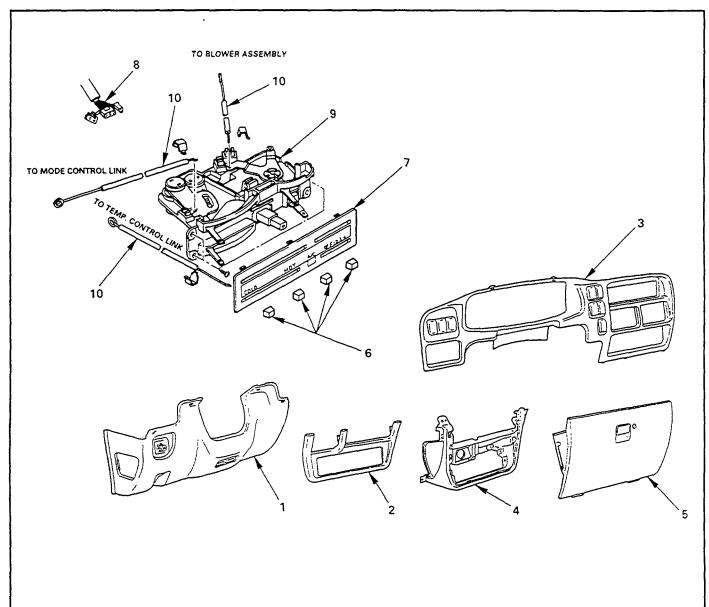
To reassemble follow the disassembly procedure in reverse order.

#### **CONTROL LEVER ASSEMBLY**





#### **REMOVAL AND INSTALLATION**

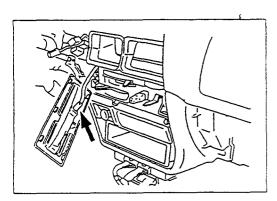


#### **Removal Steps**

- Instrument panel driver lower cover assembly
- 2. Lower cluster assembly
- 3. Meter cluster assembly
- 4. Instrument panel lower center cover assembly
- 5. Glove box
- 6. Knobs
- ♣ 7. Heater bezel
- 8. Fan control lever and / or A/C switch connector
  - 9. Control lever assembly
- ▲ 10. Cables

#### Installation Steps

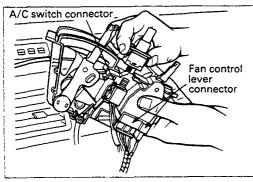
- 10. Cables
- 9. Control lever assembly
- 8. Fan control lever and / or A/C switch connector
- 7. Heater bezel
- ▲ 6. Knobs
  - 5. Glove box
  - 4. Instrument panel lower center cover assembly
  - 3. Meter cluster assembly
  - 2. Lower cluster assembly
  - Instrument panel driver lower cover assembly





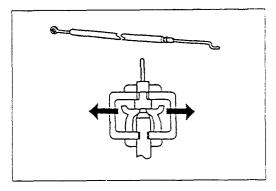
#### Important Operation—Removal

#### 7. Heater Bezel

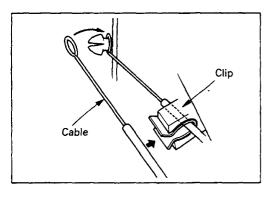


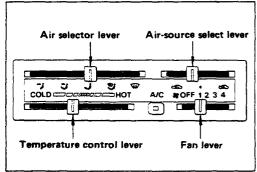
#### 8. Fan and A/C Switch Connector

Pull the control lever assembly out and disconnect the connectors.



#### 10. Cables







#### Important Operation—Installation

6. Control Lever Assembly



Adjust the control cables.

Air source control cable (Blower unit)

- (1) Slide the control lever to the left.
- (2) Connect the control cable at the "CIRC" position and fix it with the clip.

Temperature control cable (Heater unit)

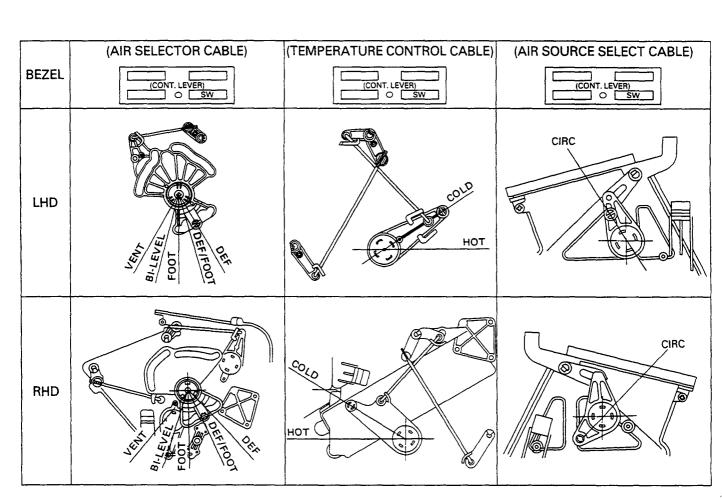
- (1) Slide the control lever to the left.
- (2) Connect the control cable at the "COLD" position and fix it with the clip.

Air select control cable (Heater unit)

- (1) Slide the control lever to the right.
- (2) Connect the control cable at the "DEFROST" position and fix it with the clip.

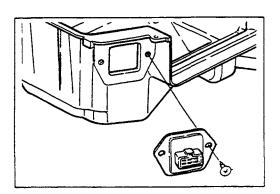


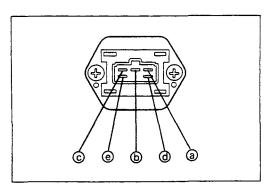
Check operation.

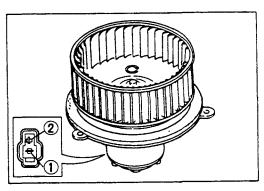




### **INSPECTION AND REPAIR**







#### Resistor

As for air-conditioning model, fixed on right side of the evaporator unit.

As for heater only model, fixed on right side of the duct placed between blower unit and heater unit.

Replace the resistor with a new one if the coil is found to be open or if the resistance value deviates from the specified range.

Terminal	Resistance
a — b	2.40 Ω
b — d	0.90 Ω
b-e	0.28 Ω
b-c	_

#### **Blower motor**

Check blower motor for smooth rotation.

Connect the battery positive terminal to the No.1 (No.2: RHD) terminal of the blower motor and negative to the No.2 (No.1:

Be sure to check to see if the blower motor operates correctly.

#### TROUBLE SHOOTING

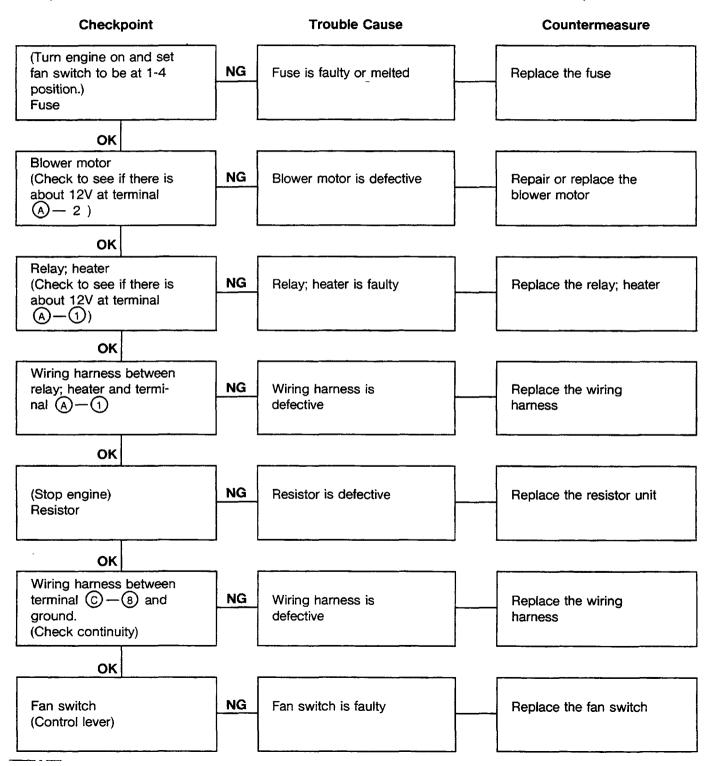
Refer to this Section to quickly diagnose and repair problems. Each troubleshooting chart has three headings arranged from left to right.

- (1) Checkpoint
- (2) Trouble Cause
- (3) Countermeasure

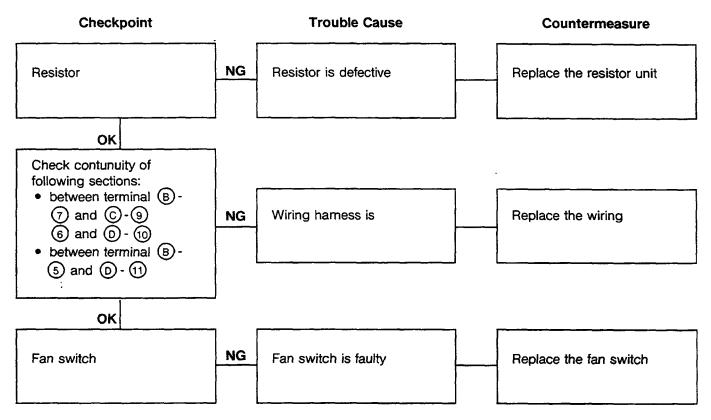
This Section is divided into seven sub-sections:

- 1. Trouble of fan control system
  - 1-A Blower motor would not rotate totally.
  - 1-B Blower motor does not rotate it fan switch position 1, 2, 3
- Trouble of Air-conditioning system
  - 2-A Magnetic clutch would not engage
  - 2-B Refrigerant system defective

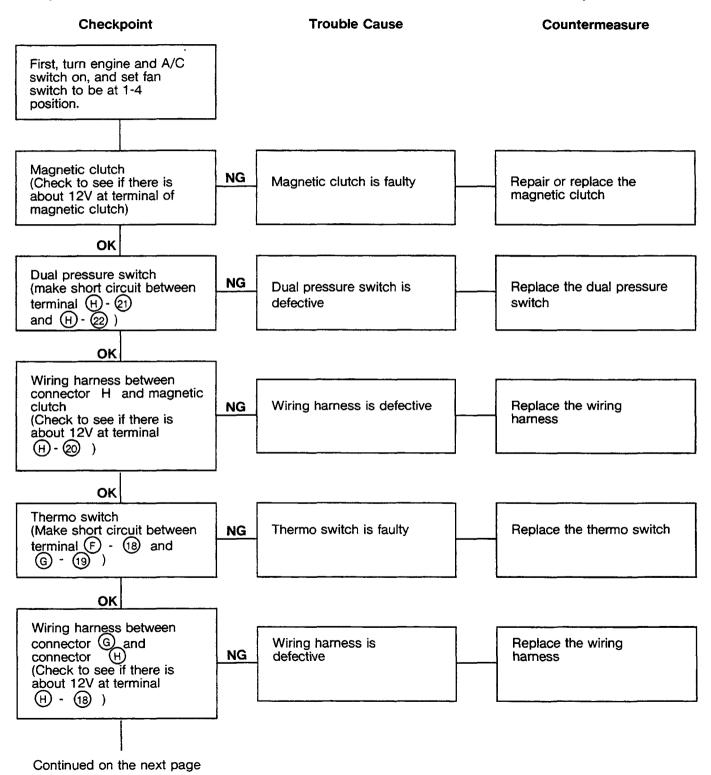
# 1-A BLOWER MOTOR WOULD NOT ROTATE TOTALLY (Refer to "WIRING HARNESS TERMINAL POSITIONS" in this section)

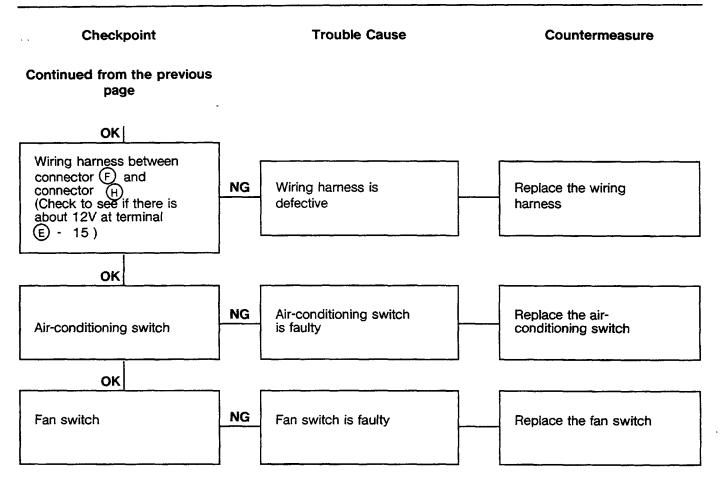


# 1-B BLOWER MOTOR DOES NOT ROTATE AT FAN SWITCH POSITION 1, 2, 3 (Refer to "WIRING HARNESS TERMINAL POSITIONS" in this section)

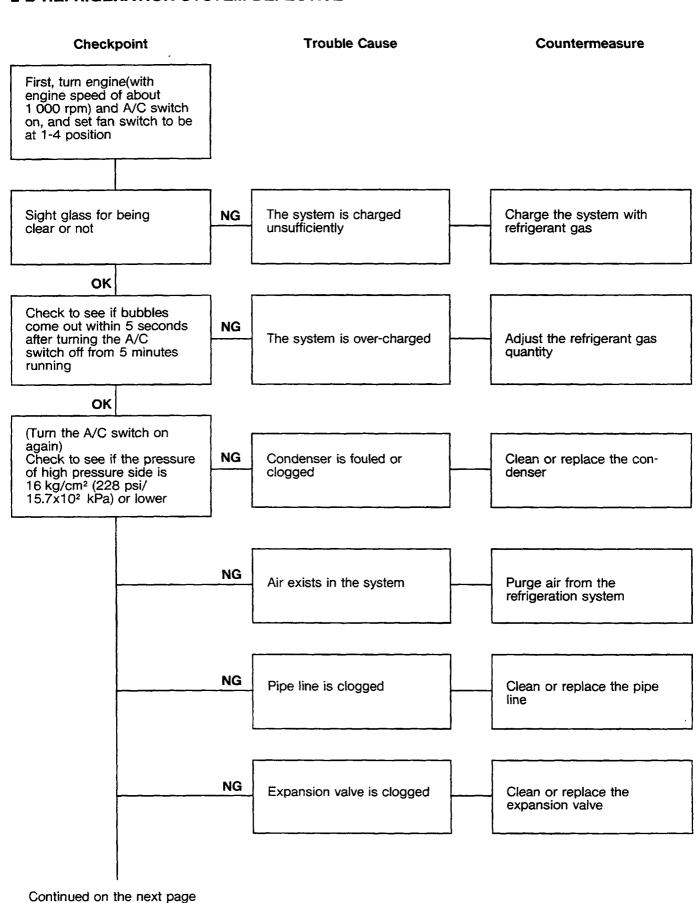


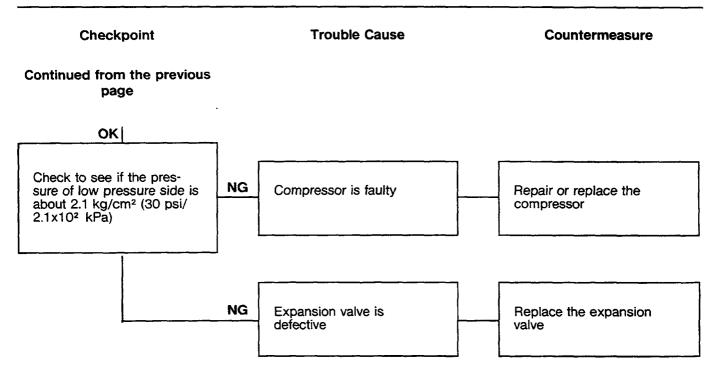
# 2-A MAGNETIC CLUTCH WOULD NOT ENGAGE (Refer to "WIRING HARNESS TERMINAL POSITIONS" in this section)





#### 2-B REFRIGERATION SYSTEM DEFECTIVE





# ISUZU<br/>KB - SERIES

# **WORKSHOP MANUAL**

**SECTION 2** 

FRAME AND CAB



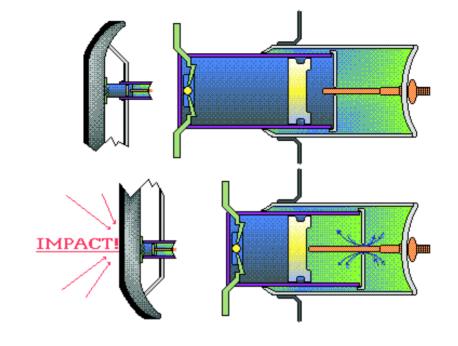


Front

Rear

Body

**Dimensions** 





# KB TF 140 Frame and Bumpers

# SECTION 2A FRAME AND BUMPER

#### **TABLE OF CONTENTS**

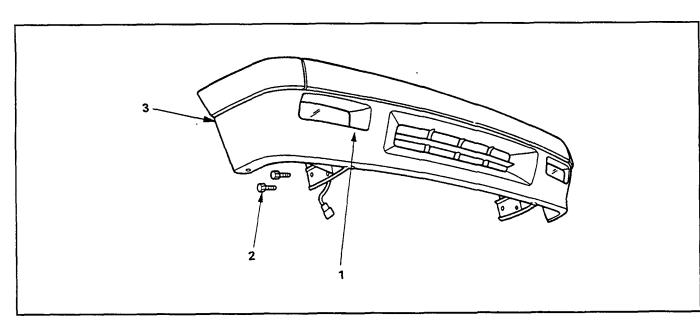
											PAGE
Front bumper	 	 		 	 		 	 	 	 	2A - 1
Removal and installation	 	 		 	 	 	 	 	 	 	2A - 1
Adjustment	 	 	• •	 	 		 ٠.	 	 	 	2A - 2
Rear bumper/step	 	 		 	 	 	 	 	 	 	2A - 3
Removal and installation	 	 		 	 	 	 	 	 	 	2A - 3
Rear Body	 	 		 	 	 	 	 	 	 	2A - 4
Removal and installation	 	 		 	 	 	 	 	 	 	2A - 4
Frame dimensions		 		 	 	 	 	 	 	 	2A - 7

#### FRONT BUMPER





#### REMOVAL AND INSTALLATION

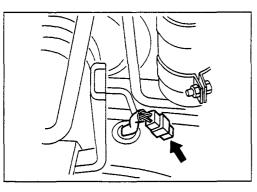


#### **Removal Steps**

- ▲ 1. Front combination light
  - 2. Bolt
  - 3. Front bumper assembly

#### Installation Steps

- 3. Front bumper assembly
- ▲ 2. Bolt
  - 1. Front combination light

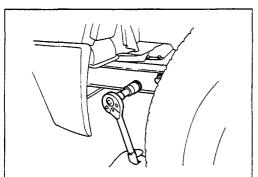




#### Important Operation – Removal

## 1. Front Combination Light

Disconnect the front combination light harness.





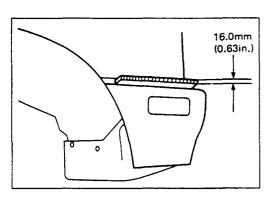
#### Important Operation - Installation



Bolt

 $\frac{\text{kg-m(lb.ft/N-m)}}{13.75 \pm 1.75 \text{ (99.6} \pm 12.7/134.9} \pm 17.2)}$ 

#### **ADJUSTMENT**





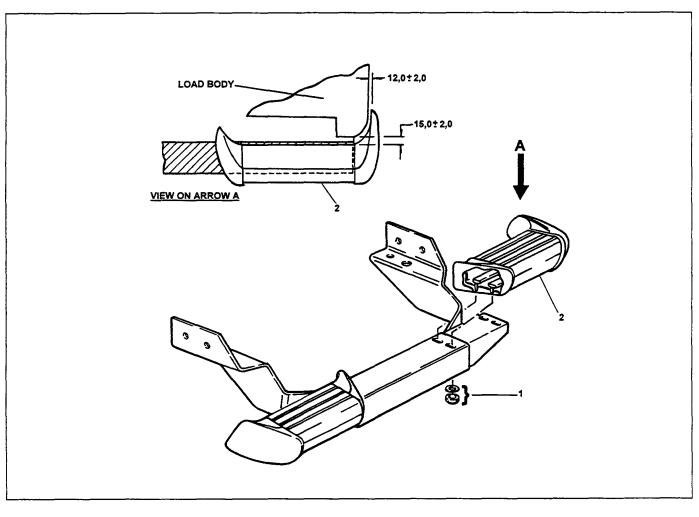
When the bolts fixing front bumper assembly are tightened, adjustment should be made with shims fitted between the back bar and front side bumper so that a clearance of 16.0 mm (0.63 in.) is provided between the lower side of the fender and the upper side of the front side bumper.

#### **REAR BUMPER/STEP**





#### **REMOVAL AND INSTALLATION**





#### **Removal Steps**

- 1. Remove four locknuts and washers.
- 2. Remove bumper step from towbar.



#### **Installation Steps**

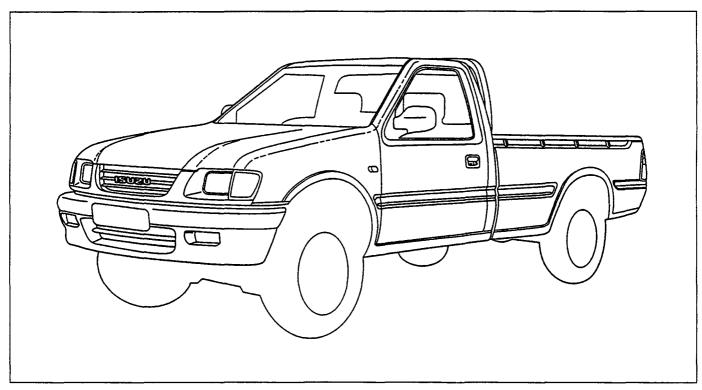
- 1. Align T-bolts in bumper/step with slots in tow bar.
- 2. Fit four locknuts and washers as shown.
- 3. Align bumper/step to towbar and body as indicated.
- 4. Tighten locknuts to 4,0 4,5 N.m.

#### **REAR BODY**





#### **REMOVAL AND INSTALLATION**



#### **Removal Steps**

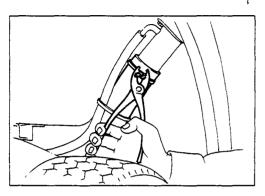
- 1. Battery ground cable
- 2. Rear combination lamp harness
- ▲ 3. Fuel filler pipe and evaporator hose
  - 4. Spare tyre
  - 5. Bolt ; frame to rear body
- ▲ 6. Rear body assembly

#### **Installation Steps**

- 6. Rear body assembly
- ▲ 5. Bolt ; frame to rear body
  - 4. Spare tyre
  - 3. Fuel filler pipe and evaporator hose
  - 2. Rear combination lamp harness
  - 1. Battery ground cable

#### NOTE:

The rear body must be empty before removal.

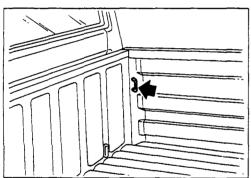




#### Important Operations - Removal

#### 3. Fuel Filler Pipe and Evaporator Hose

Disconnect the fuel filler pipe and evaporator hose.

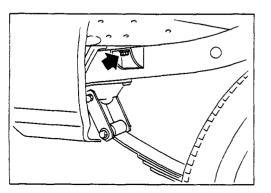


#### 6. Rear Body Assembly

Attach lifting wires to the four rear body hooks and raise the rear body.

#### Note:

In lifting up rear body, take care not to dash it against cab body.



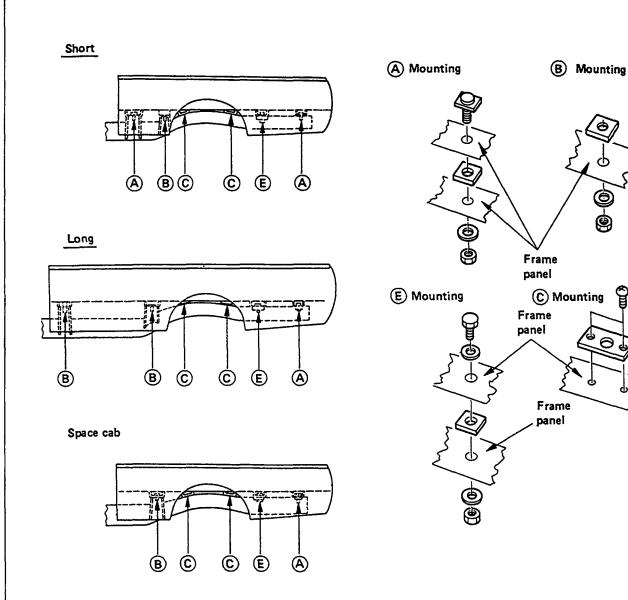


Important Operations — Installation

5. Bolt; Frame to Body

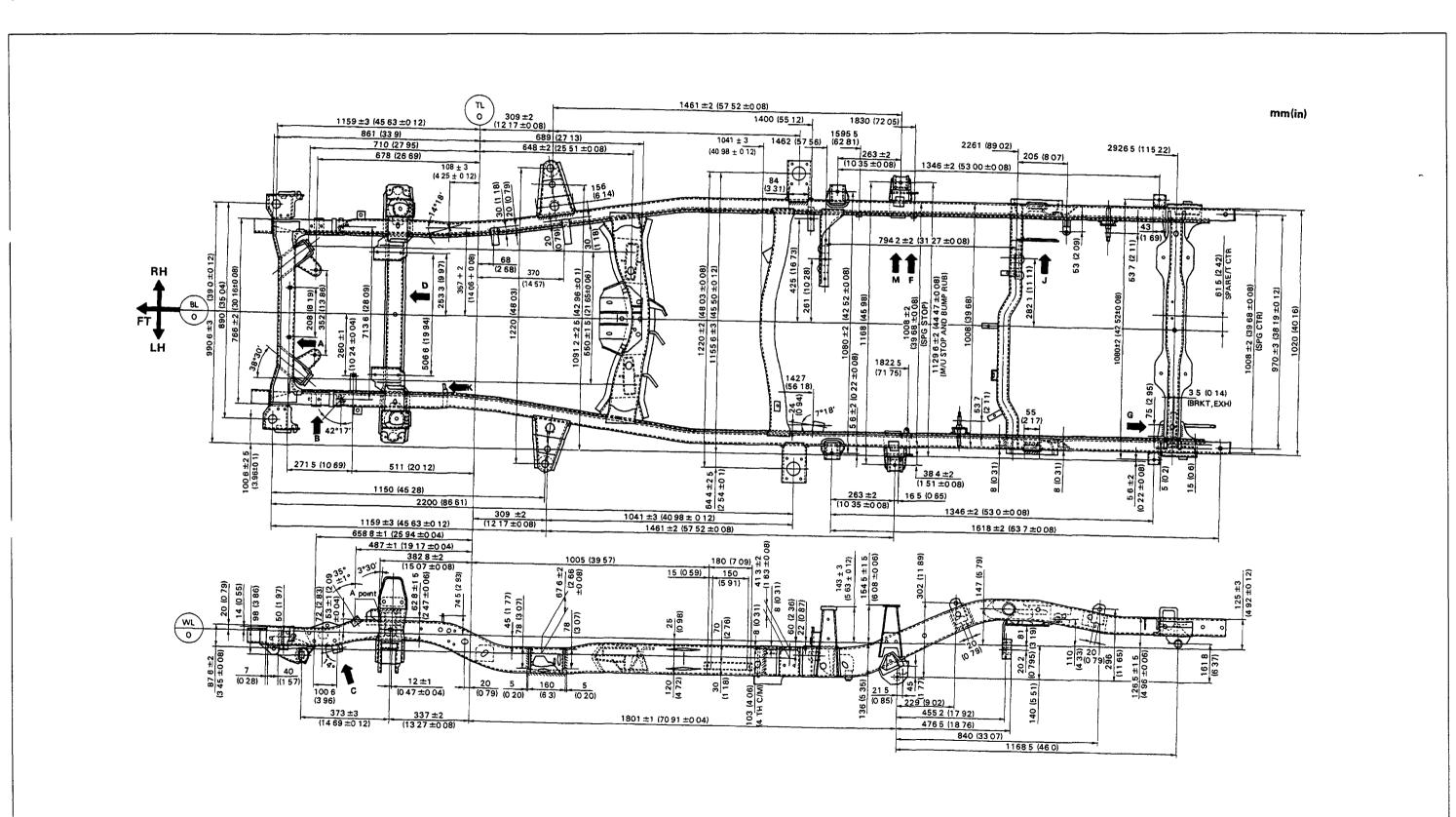
Torque  $kg \cdot m(lb.ft/N \cdot m)$  $6.5 \pm 1.5 (47 \pm 10.8/63.8 \pm 14.7)$ 

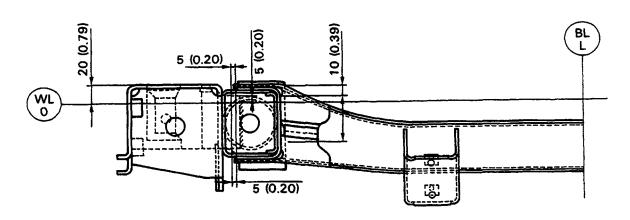
#### **BODY MOUNTING**



#### FRAME DIMENSIONS

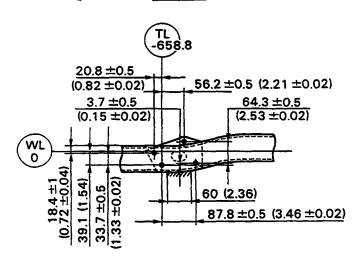
(4 X 4, LONG WHEEL BASE MODEL)



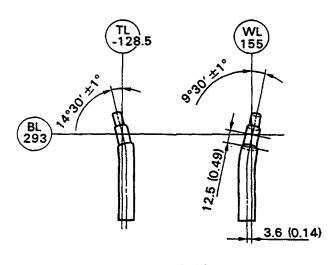


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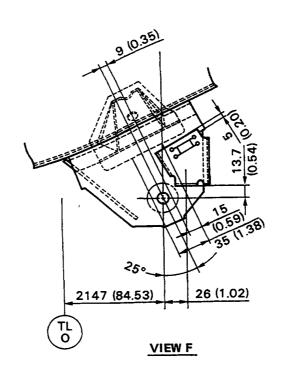
#### VIEW A

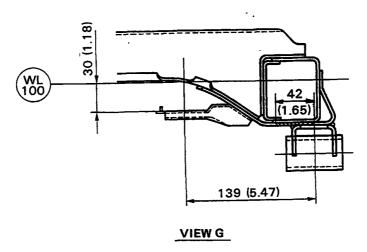


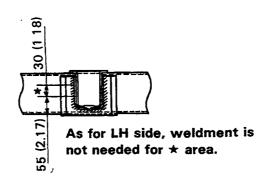
#### VIEW B



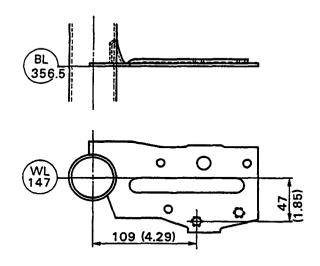
VIEW E

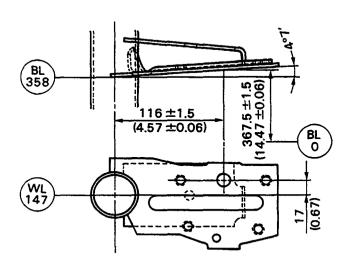






SECT P-P

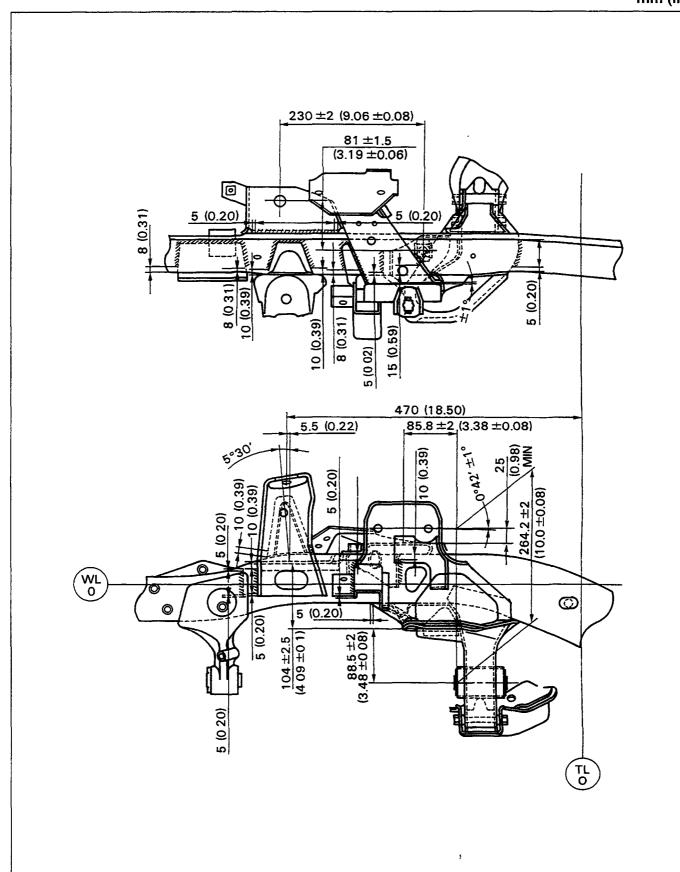


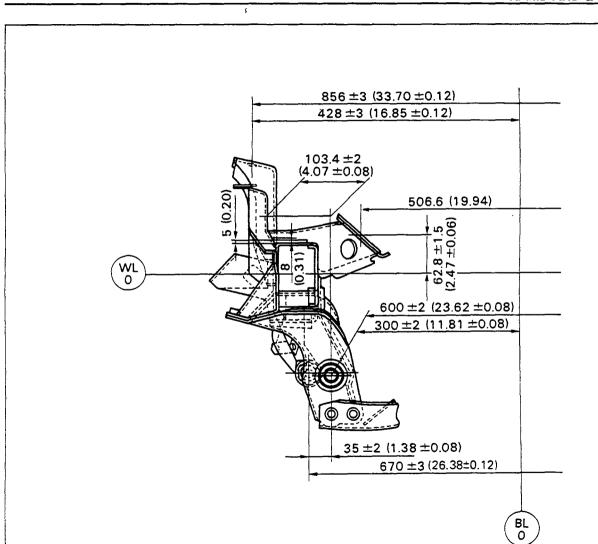


VIEW J

#### FRONT SUSPENSION DETAILS

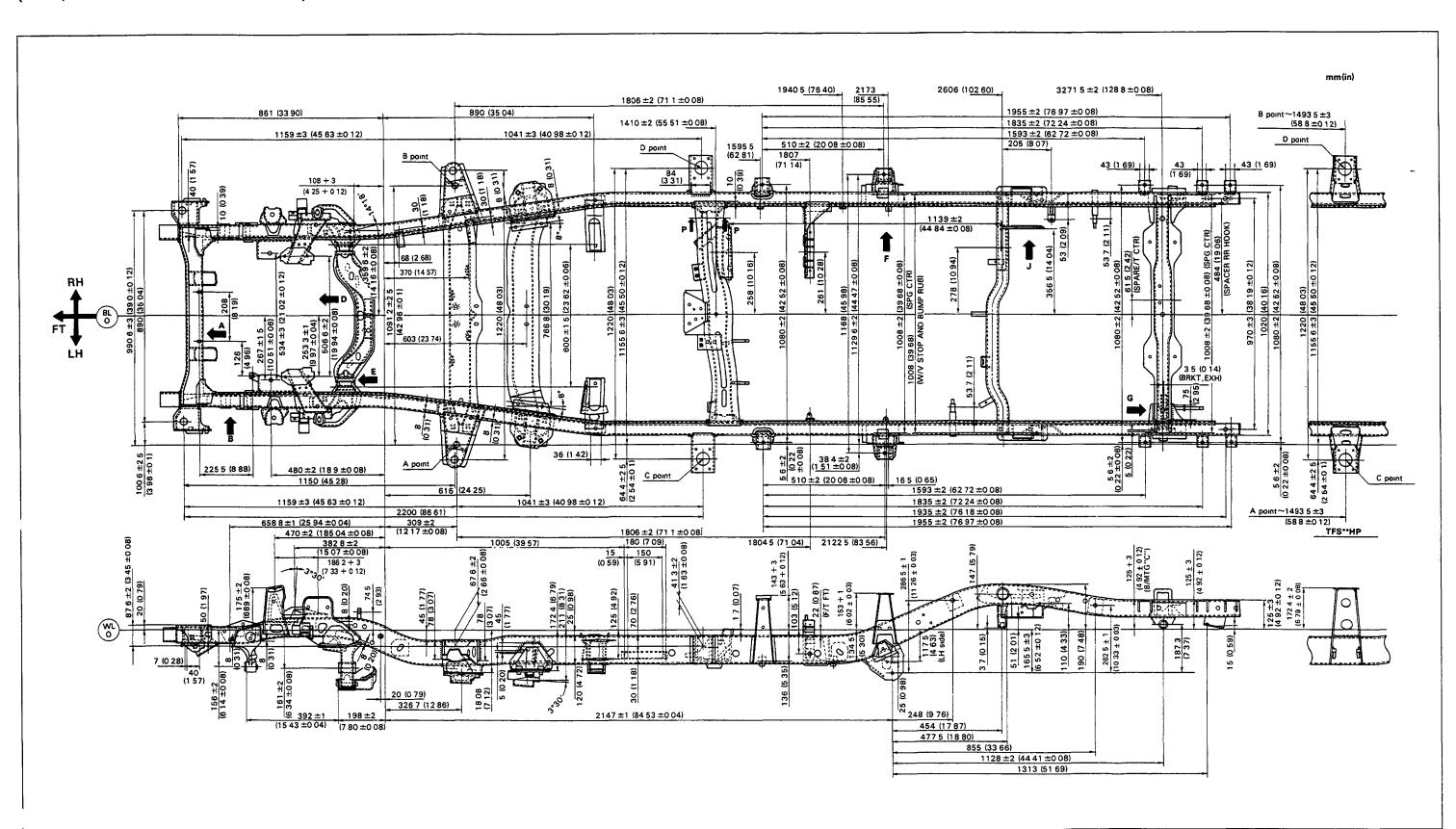
mm (in.)

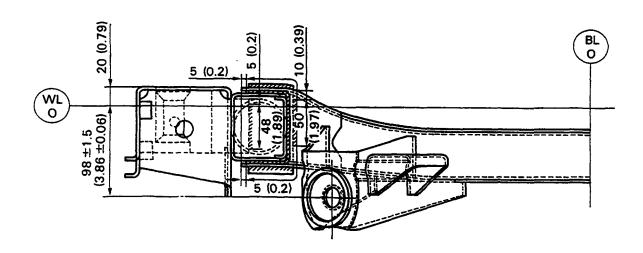




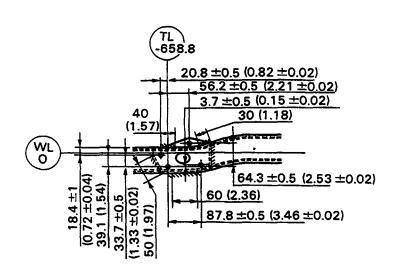
#### FRAME DIMENSIONS

(4 X 2, SHORT WHEEL BASE MODEL)

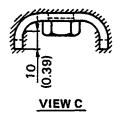


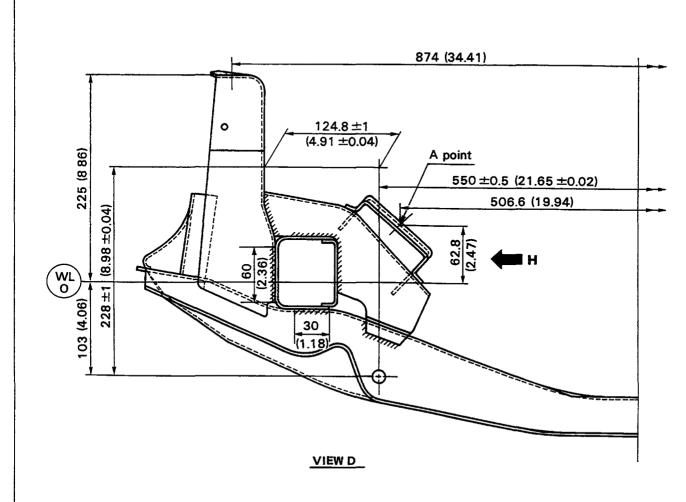


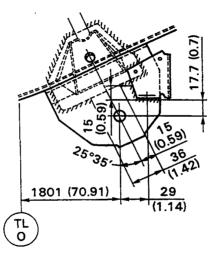
#### VIEW A



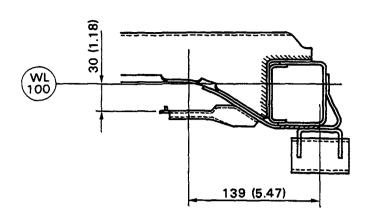
#### VIEW B



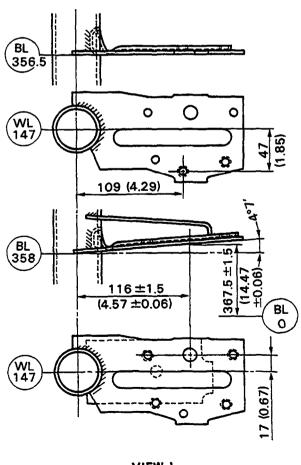




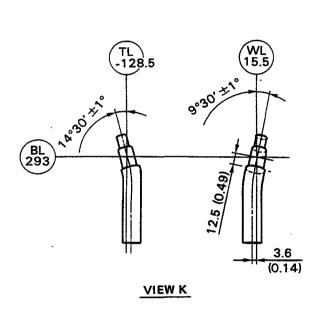
VIEW F

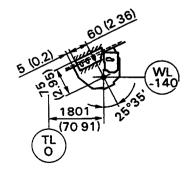


VIEW G



VIEW J

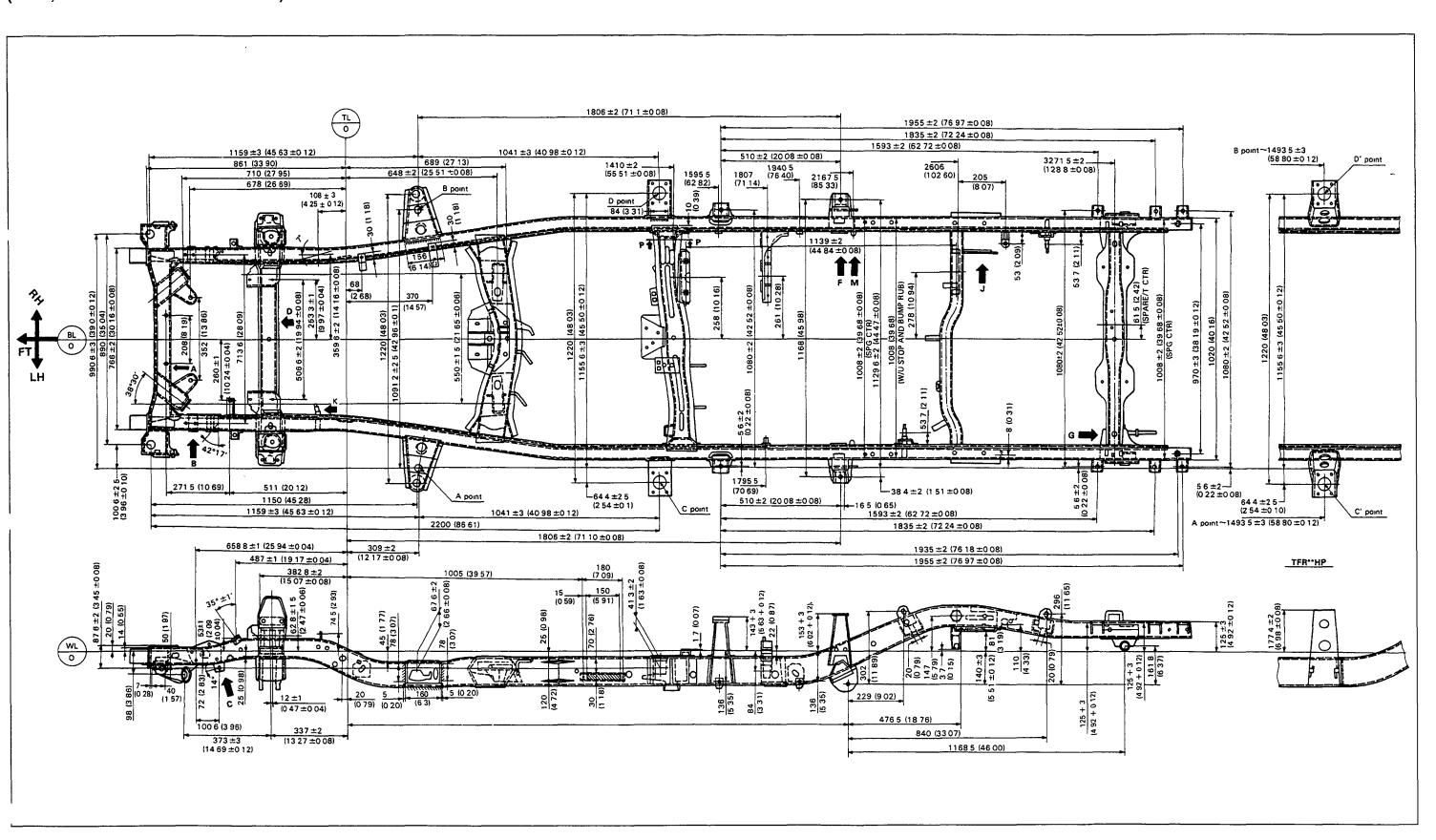


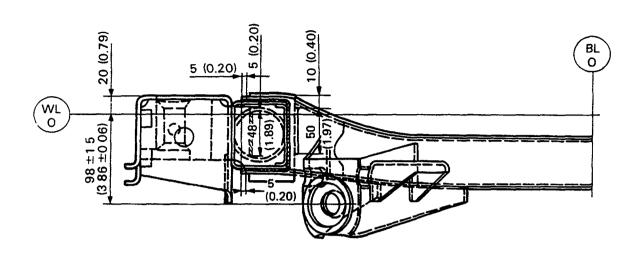


VIEW M

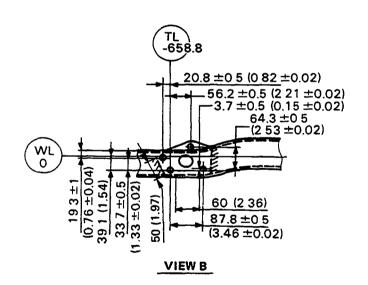
#### FRAME DIMENSIONS

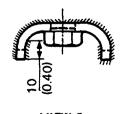
(4 X 2, LONG WHEEL BASE MODEL)



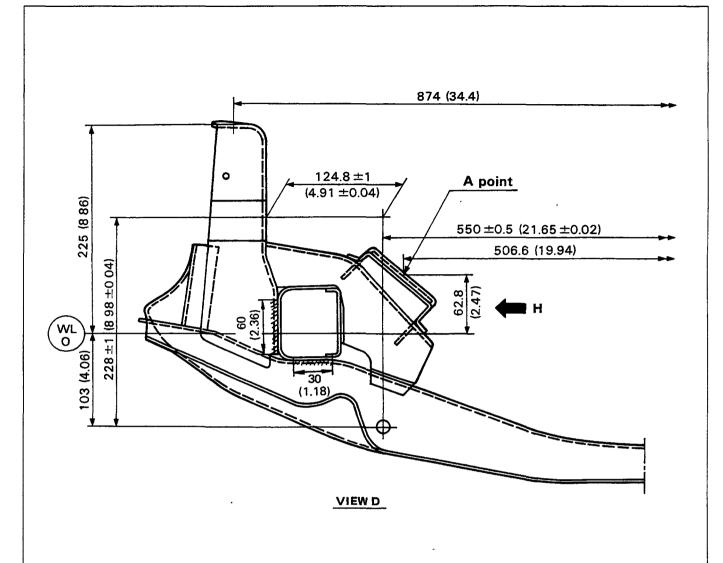


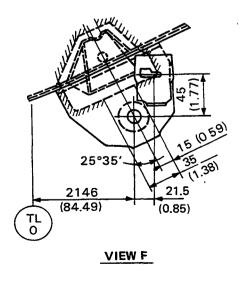
#### VIEW A

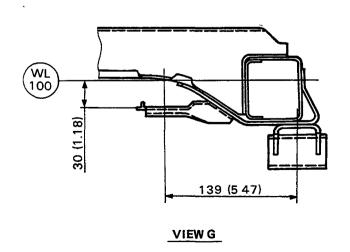


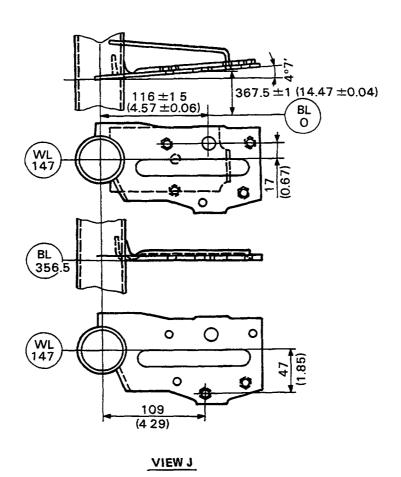


VIEW C



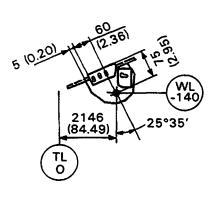




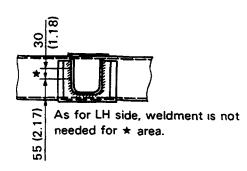


TL -128.5 BL 293 BL 293 SO (0.14)

VIEW K



VIEW M



## ISUZU KB-SERIES

# WORKSHOP MANUAL

SECTION 2B

SHEET METAL

### SECTION 2B SHEET METAL

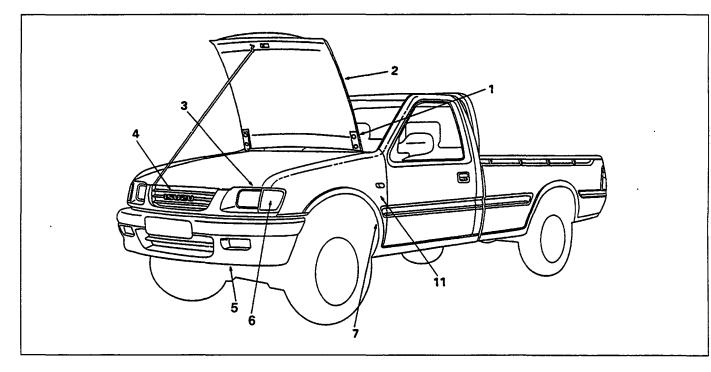
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Adjustment 2B-	- 5
Cab protector 2B-	
Removal and installation 2B-	
Exterior rope hook 2B-	
Removal and installation 2B-	
Interior rope hook2B-	- 8
Removal and installation 2B-	





#### →← REMOVAL AND INSTALLATION



#### **Removal Steps**

#### **Engine Hood**

- ▲ 1. Bolt.
  - 2. Engine hood assembly

#### **Fender**

- 3. Combination lamp connector
- ▲ 4. Radiator grille
  - 5. Bumper assembly
- ▲ 6. Combination lamp
- ▲ 7. Inner liner
  - 8. Steering lower cover or speaker grille
  - 9. Antenna cable (Passenger side)
  - 10. ECM box (Driver side)
- 11. Fender

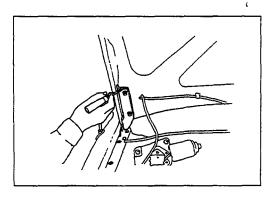
#### **Installation Steps**

#### Fender

- 11. Fender
- 10. ECM box (Driver side)
- 9. Antenna cable (Passenger side)
- 8. Steering lower cover or speaker grille
- 7. Inner liner
- 6. Combination lamp
- 5. Bumper assembly
- 4. Radiator grille
- 3. Combination lamp connector

#### **Engine Hood**

- 2. Engine hood assembly
- 1. Bolt

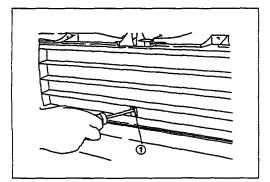




#### Important Operations - Removal

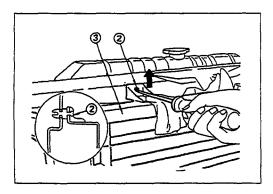
#### 1. Bolt

Before removing the hinges from the engine hood, scribe a mark showing of the hinges to facilitate installation in the original position.



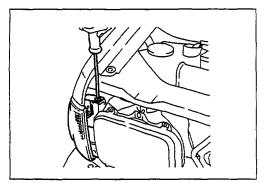
#### 4. Radiator Grille

Remove the radiator grille centre bolt (1).



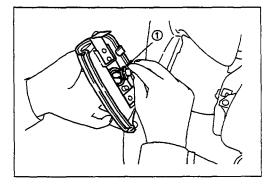
Use a screwdriver to raise the clip (2) and release the lock. Place a clean rag beneath the screwdriver tip to protect the body painted surfaces.

Remove the radiator grille (3).



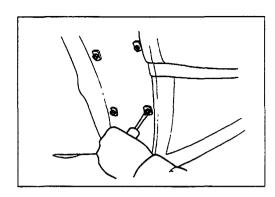
#### 6. Combination Lamp

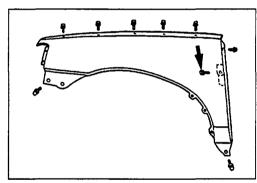
Remove the combination lamp fixing screws.

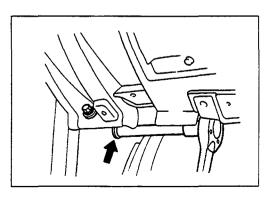


Turn the socket (1) counterclockwise to disconnect it from the marker light housing.

Pull the bulb from the socket.







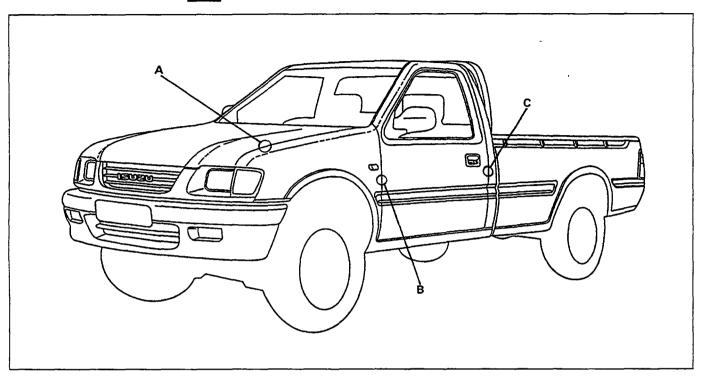
#### 7. Inner Liner

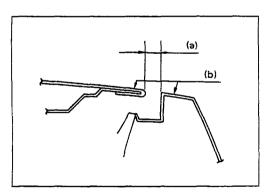
Remove the inner liner fixing screws.

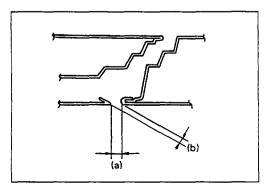
#### 11. Fender

First, remove the bolt (See illustration arrow mark) from the inside of the car.

#### **ADJUSTMENT**







#### A. Check the Engine Hood and Fender

	mm(in).
Clearance (a)	4 (0.157)
Height (b)	Flush

Adjust the clearance (a) with the hinges on the engine hood.

Adjust the step (b) with the hood rests.

- B. Check the Fender and Door
- C. Check the Door and Body
- D. Check the Front Door and Rear Door

	mm(in).
Clearance (a)	5.5 (0.217)
Height (b)	Flush

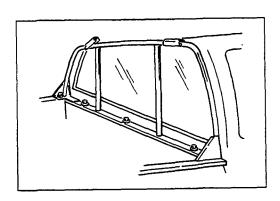
Adjust the clearance (a) with the door hinges. Adjust the step (b) by tapping on the fender lightly with a rubber hammer.

#### **CAB PROTECTOR**





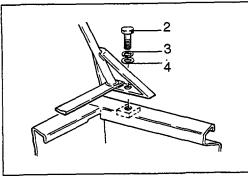
#### **REMOVAL AND INSTALLATION**





#### Removal

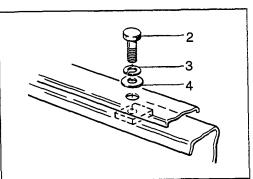
- 1. Using a 13 mm spanner remove securing bolt (2) and ensure washers (3 and 4) are kept together with each bolt
- 2. Lift up and remove cab protecter unit from pick-up box.





#### Installation

- 1. Position cab protecter unit in place above the holes in side rails and front rail.
- 2. Place washers (3 and 4) onto bolt (2) and screw bolts into existing weldnuts on side rails and front rail.

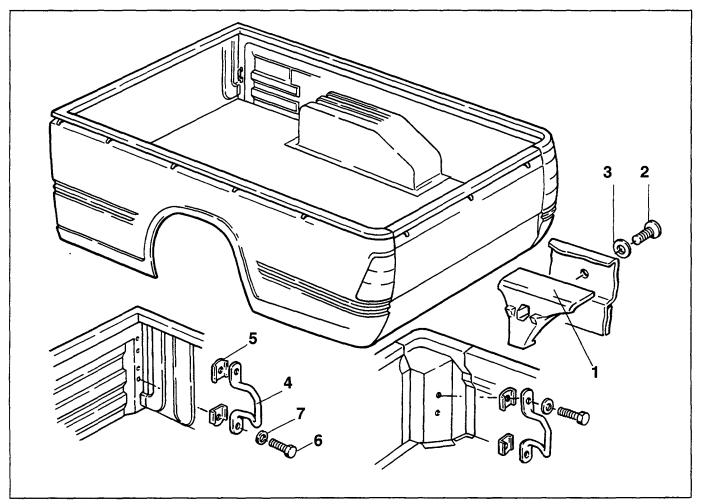


#### **EXTERIOR ROPE HOOK**





#### **REMOVAL AND INSTALLATION**





#### Removal

1. Hold rope hook (1) firmly and using a Phillips screw driver remove screws (2).

Note: Ensure washer (3) is kept with each screw (2).



#### Installation

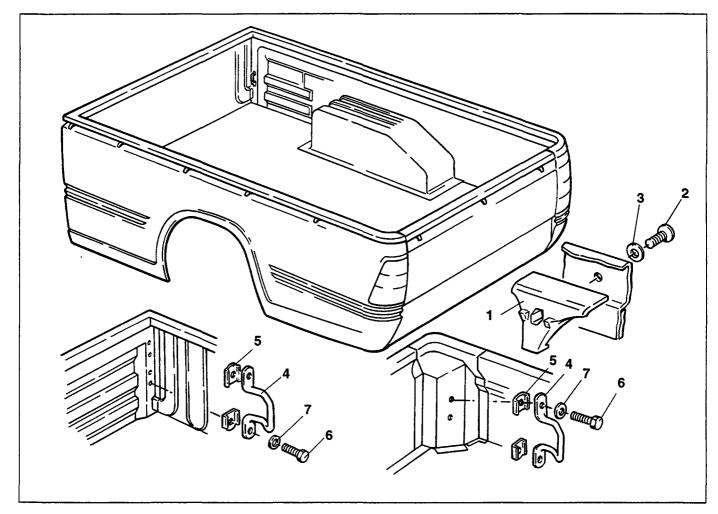
- 1. Place rope hook (1) from underneath the rail ensuring that hole in item (1) and hole in rail lines up.
- 2. Place washer (3) on screw (2) and tighten onto rail accordingly.

#### **INTERIOR ROPE HOOK**

**+**+



#### **REMOVAL AND INSTALLATION**





#### Removal

1. Using a 13 mm socket/spanner remove bolts (6).

Note: Keep item 6 together with items 4, 5 and 7.



#### Installation

- 1. Position item 5 with round edge corresponding with rounded edge of item 4.
- 2. Place item 7 onto item 6 and insert through holes of item 4 and 5.
- 3. Secure to existing weld nuts in front and rear corner posts.

# ISUZU<br/>KB - SERIES

#### **WORKSHOP MANUAL**

**SECTION 3** 

STEERING, SUSPENSION, WHEELS AND TYRES









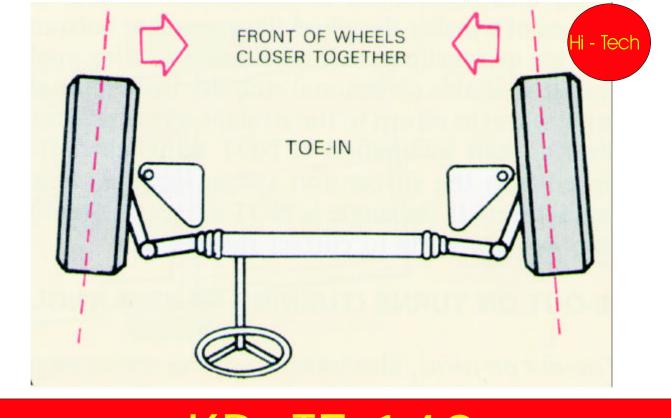


Caster

Camber

Toe-In

Trim-Height



## KB TF 140 Alignment



## SECTION 3A FRONT ALIGNMENT

#### **TABLE OF CONTENTS**

	PAGE
Alignment	. 3A-2
Caster	. 3A-2
Camber	. 3A-3
Toe-in	. 3A-4
Trim Height or Vehicle Height	. 3A-4
Strut Bar	. 3A-6

#### 3A - 2 FRONT ALIGNMENT

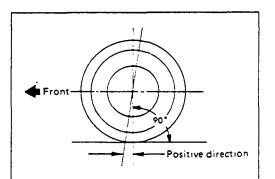
- Tyre pressure and abnormal wear
- Front hub bearings for axial play
- Ball joints on steering linkage for play
- Suspension ball joint
- Operation of shock absorber
- Tightness of suspension parts



#### **ALIGNEMENT**

#### Inspection of Wheel Alignment

The points listed in table at left must be checked prior to inspecting front wheel alignment.



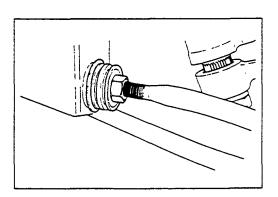


#### **CASTER**

	Short Wheel Base	Long Wheel Base
4 x 2 model	1*35' ± 45'	1°50' ± 45'
4 x 4 model	1°55' ± 45'	2°10' ± 45'
4 x2 Flat Deck		1°10' ± 45'
4 x 4 Flat Deck		2°10' ± 45'

#### Note:

Left and right side to be equal within 35'.

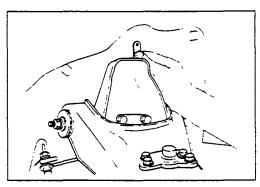




#### [4 x 2 Model]

The caster angle can be adjusted by varying lenght of the strut bar (adjust with lock nut) and shims should not be used for adjustment.

ised for adjustifierit.	
ock Nut Torque	kg-m(lb.ft/N-m
13.0 ± 1.	3 (94.0 ± 9.4/127.5 ± 12.8)



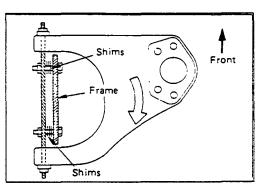


#### [4 x 4 Model]

The caster angle can be ajusted by means of the caster shims installed in position between the chassis frame and fulcrum pins.



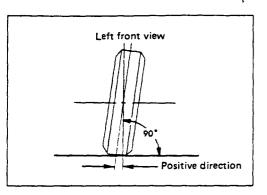
Difference of the caster shim front/rear tickness shall be 3.2 mm (0.126 in) or less. Overall tickness of caster shim shall be 10.8 mm (0.425 in) or less.





Position	of shims	Caster angle
Front side	Rear Side	
When added	When removed	Decreases
When removed	When added	Increases

Fulcrum Pin Bolt Torque	kg•m(lb.ft/N•m)
15.5 ± 1.5 (112.1	± 10.8/152.0 ± 14.7)





#### CAMBER

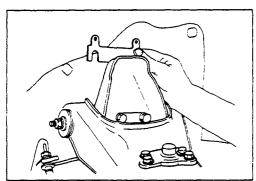
30' ± 60'

#### Note:

Left and right side to be equal within 45'.

<b>KING</b>	PIN	INCL	INA	TIO	N
-------------	-----	------	-----	-----	---

 $10^{\circ} \pm 60'$ 



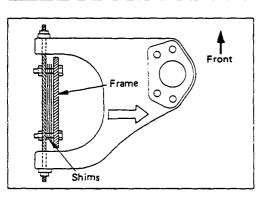


#### [4 x 4 Model Only]

The camber angle can be adjusted by means of the camber shims installed in position between the chassis frame and fulcrum pins.

#### Note:

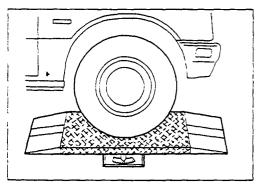
Overall thickness of caster shim and chamber shim shall be 10.8 mm (0.425 in) or less.





Position of shims	Camber angle
When added	Decreases
When removed	Increases

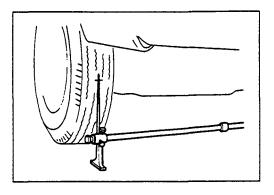
Fulcrum Pin Bolt Torque	kg·m(lb.ft/N·m)
15.5 ±1.5 (112.1 ±10.	$.8/152.0\pm14.7)$

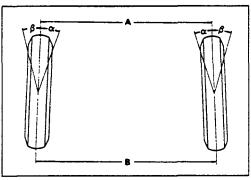


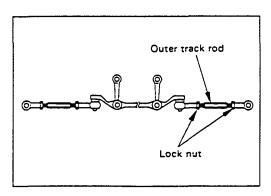
#### Measurement of Side Slippage

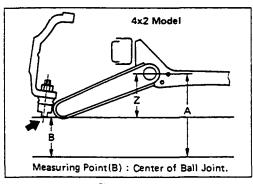
When inspection and adjustments of toe-in, camber, caster and kingpin inclination are completed, check for side slippage using a side slip tester.

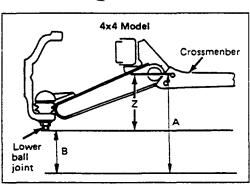
Roll the wheels over the side tester as slowly as possible and take reading on the tester. If the amount of side slippage is in excess of 5 mm per 1 m, recheck the wheel alignment.













#### TOE-IN

Measurement should be taken with the vehicle on a surface

If a surface plate is not available, toe-in should be checked with the vehicle parked on a level floor.

- 1. Set front wheels to straight ahead position.
- 2. Align the toe-in gauge with centre height of each wheel at front end.
- 3. Apply centre marks to each wheel, then take measurement of distance A between the centre marks on each wheel.
- 4. Slowly move the vehicle rearward until the centre marks reach the rear end position.
- 5. Take measurements of distance B between the centre marks at rear end.

The toe-in can be calculated with next formula.

Toe-in = B - A

oe-in r	
4 x 2	$2 \pm 2 \ (0.08 \pm 0.08)$
4 x 4	$2 \pm 2 (0.08 \pm 0.08)$





To adjust the toe-in angle, loosen the lock nut on the outer track rod and turn the outer track rod with the same degree at right and left. mm(in).

Lock Nut Torque	mn
$10.0 \pm 1.0 \ (72.3 \pm 7.2/98.1 \pm 9.8)$	



#### TRIM HEIGHT OR VEHICLE HEIGHT

Trim Height: at Curb Weight

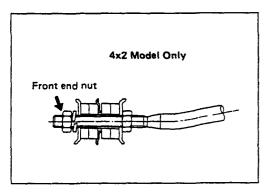
Trim height (Z) = A - B

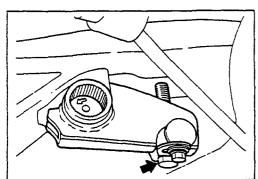
Front		mm(in).
	Model	Z
14" Wheels	4 x 2	56 (2.20)
15/16" Wheels	4 x 4	130 (5.12)
15" Wheels	4 x 2	68 (2.68)

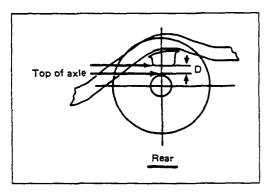
#### Note:

Difference in trim height LHS to RHS should be within 3,0 mm.

Trim height and vehicle height measurements are interchangeable.







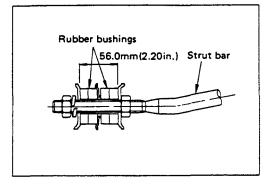


#### Adjustment

Adjust the trim height by means of the adjusting bolt on the height control arms.

- 1. Check and adjust the tyre inflation pressures.
- Park the vehicle on a level ground and move the front of the vehicle up and down several times to settle the suspension.
- Loosen the nuts on the front end of the strut bar. (For 4 x 2 model only.)
- 4. Make necessary adjustment with the adjusting bolt on the height control arms.

Reference Data	<del></del>	mm(in).	
	4 x 2	4 x 4	
	4 X Z	Others	Australia
Standard	90 (3.54)	95 (3.74)	95 (3.74)
Heavy Duty Sus.	90 (3.54)	95 (3.74)	
Flat Deck	65 (2.56)	70 (2.76)	



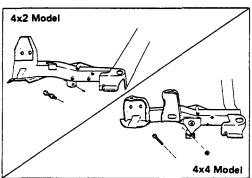


#### STRUT BAR

Securely Tighten the Strut Bar Nuts (4 x 2 Model Only)

Strut Bar Torque

 $13.0 \pm 1.3 (94.0 \pm 9.4/127.5 \pm 12.8)$ 

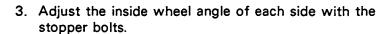


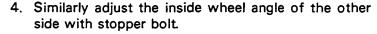


#### MAXIMUM STEERING ANGLE ADJUSTMENT

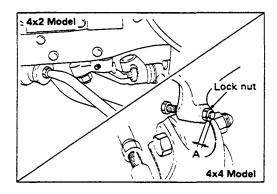
The maximum steering angle of the front wheels can be adjusted with the stopper bolts under the frame side members.

- 1. Position each front wheel on the turning radius gauge in a straight-ahead position.
- 2. Set the parking brake firmly.





	4 x 2	4 x 4
Outside wheel	33°	33°
Inside wheel	37° ±0;	35° ±0;



#### Note:

Maximum steering angles should be set after adjusting front wheel alignment.

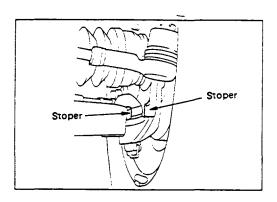
4 x 4 Model Only	mm(in)
A	0-8.5 (0-0.33)



Stopper Bolt Lock Nut Torque		kg·m(lb.ft/N·m)
4 x 2	4.5 ±1.0 (32.6 ±	7.2/44.1 ±9.8)
4 x 4	2.3 ±0.3 (16.6 ±	=2.2/22.5 ±2.9)

#### 4 x 4 Model Only

If the stopper (non-adjustable) between the lower link end and the knuckle comes ahead of the stopper bolt, adjust the stopper bolt so that the inner-side stopper bolt touches the drop arm (relay lever).













# Index

Servicing

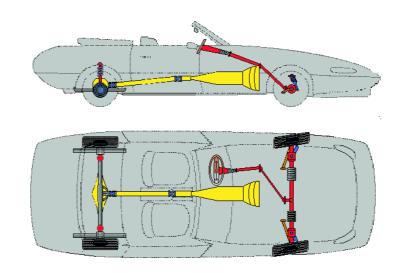
Specs.

Column

Unit

Power

Linkage



# KB TF 140 Steering



# SECTION 3B STEERING

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Reassembly ...... 3B-54

# MAIN DATA AND SPECIFICATIONS

	Manual steering	Power steering
Unit type	Recirculating ball	Integral, ball screw
Gear ratio	20.5 – 23.5	15.2 : 1
Sector shaft operating angle degree	95	94
Starting torque kg·m (lb.ft)	0.065 0.11 (0.47 0.79)	0.06 - 0.09 (0.43 - 0.65)
Maximum oil pressure kg/cm² (psi/kPa)	_	90 (1280 / 8826)
Oil pump type		Vane
Steering wheel – Diameter mm (in.)	382 (15.04)	
Steering wheel – Free play mm (in.)	10 – 30 (0.394 – 1.181)	10 (0.394)
Oil capacity liters (US pint / UK pint)	0.4 (0.85 / 0.70) Gear oil GL-5 grade	1.0 (2.13 / 1.75) ATF

# **TORQUE SPECIFICATIONS**



# **STANDARD BOLTS**

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m / lb·ft)

	Strength 4.8/4T 7T 8.8			9.8/9 <b>T</b>		
	Class	,	- •	Refined	Non-Refined	0.0,0.
	Bolt Identifi- cation	4		8	8	9
	Bolt Diameterx Pitch (mm)	No mark				
	M6 × 1.0	6 (0.6 / 52 lb·in)	7 (0.7 / 61 lb·in)	8 (0.8 /	69 lb·in)	_
<u> </u>	M8 × 1.25	13 (1.3 / 113 lb·in)	17 (1.7 / 12)	1	0 / 14)	24 (2.4 / 17)
&	$M10 \times 1.25$	27 (2.8 / 20)	37 (3.8 / 27)		3 / 31)	50 (5.1 / 37)
2	M12 × 1.25	61 (6.3 / 45)	76 (7.8 / 56)	1	9 / 64)	95 (9.7 / 70)
P	$M14 \times 1.5$	96 (9.8 / 71)	116 (11.8 / 85)		3.6 / 98)	142 (14.5 / 105)
1 5	M16 × 1.5	130 (13.3 / 96)	170 (17.3 / 125)	1	.7 / 143)	200 (20.4 / 148)
) <u>ê</u>	M18 × 1.5	188 (19.2 / 139)	244 (24.9 / 180)		.3 / 205)	287 (29.3 / 212)
=	M20 × 1.5	258 (26.3 / 190)	337 (34.4 / 249)		.3 / 284)	396 (40.4 / 292)
l a	M22 × 1.5	332 (33.9 / 245)	453 (46.3 / 335)		.7 / 381)	530 (54.1 / 391)
Standard Hex. Head Bolt	M24 × 2.0	449 (45.8 / 331)	570 (58.2 / 421)	1	.3 / 480)	692 (70.6 / 511)
St	* M10 × 1.5	26 (2.7 / 20)	36 (3.7 / 27)		2 / 30)	48 (4.9 / 35)
	* M12 × 1.75	57 (5.8 / 42)	71 (7.2 / 52)	1	2 / 59)	89 (9.1 / 66)
	* M14 × 2.0	89 (9.1 / 66)	110 (11.2 / 81)	l	2.7 / 92)	133 (13.6 / 98)
	* M16 × 2.0	124 (12.7 / 92)	162 (16.5 / 119)		.9 / 137)	191 (19.5 / 141)
	M6 × 1.0	7 (0.7 / 61 lb·in)	8 (0.8 / 69 lb·in)	!	78 lb·in)	
	M8 × 1.25	15 (1.5 / 11)	19 (1.9 / 14)	l	2 / 16)	26 (2.7 / 20)
	M10 × 1.25	31 (3.2 / 23)	41 (4.2 / 30)	i '	8 / 35)	56 (5.7 / 41)
	M12 × 1.25	69 (7.0 / 51)	85 (8.7 / 63)	1	9 / 72)	106 (10.8 / 78)
	M14 × 1.5	104 (10.6 / 77)	126 (12.8 / 93)	1	.6 / 106)	154 (15.7 / 114)
<del> </del>	M16 × 1.5	145 (14.8 / 127)	188 (19.2 / 139)	214 (21	.8 / 158)	221 (22.5 / 163)
<b>6</b>	M18 × 1.5	-	_	-	-	-
gc	M20 × 1.5	-	_	-	-	-
Flange Bolt	M22 × 1.5	-	_	-	-	_
<u> </u>	M24 × 2.0	20 /2 1 / 22\	40 /4 1 / 20\	40/4	- 7 / 3 4\	F4 /F F / 40\
	* M10 × 1.5	30 (3.1 / 22)	40 (4.1 / 30)		7 / 34)	54 (5.5 / 40)
	* M12 × 1.75	64 (6.5 / 47)	78 (8.0 / 58)		1 / 66)	99 (10.1 / 73)
	* M14 × 2.0	97 (9.9 / 72)	119 (12.1 / 88)		8 / 99.7)	144 (14.7 / 107)
	* M16 × 2.0	137 (14.0 / 101)	178 (18.2 / 132)	203 (20	.7 / 150)	210 (21.5 / 155)

The asterisk \* indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.



# **FLARE NUTS**

N·m (kg·m / lb-ft)

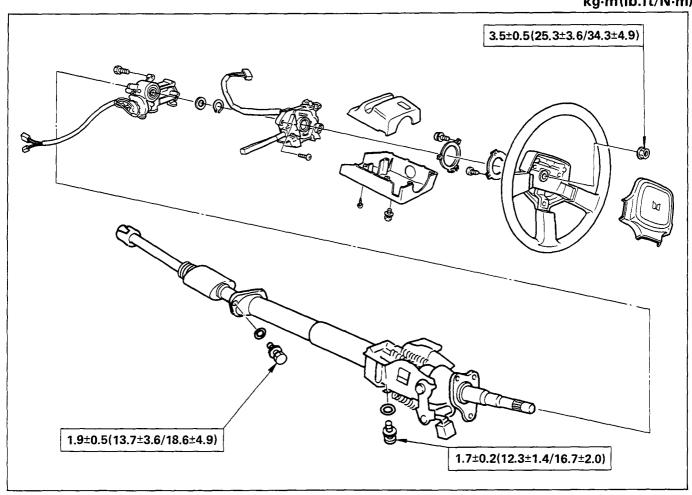
Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)



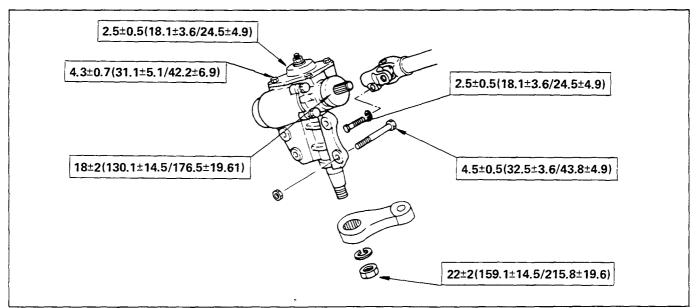
# SPECIAL PARTS FIXING NUTS AND BOLTS

#### STEERING COLUMN

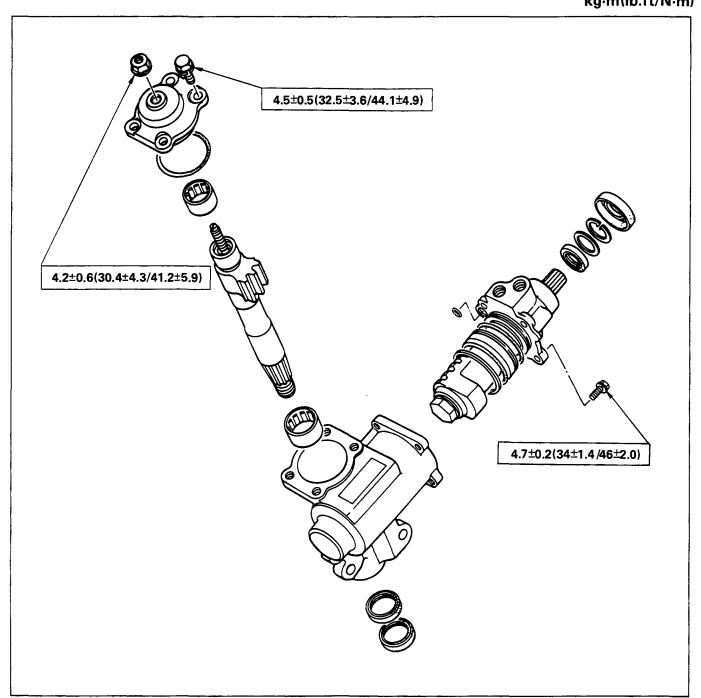
kg·m(lb.ft/N·m)



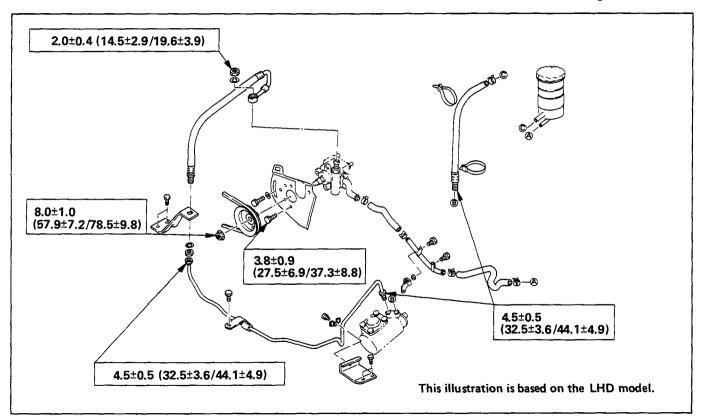
#### STEERING UNIT



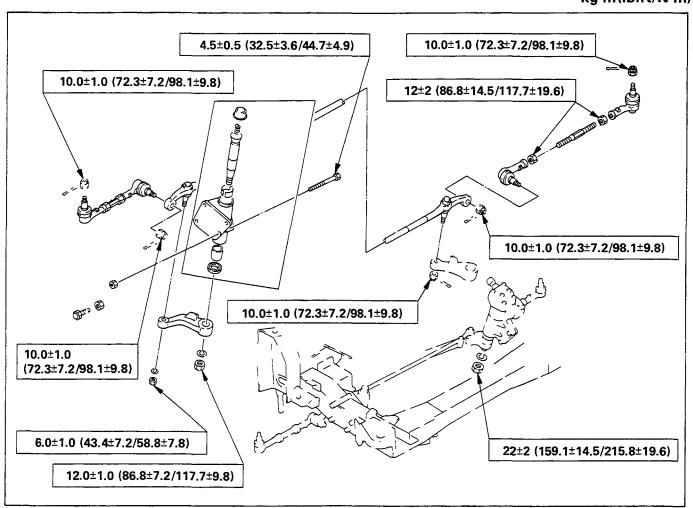
#### **POWER STEERING UNIT**



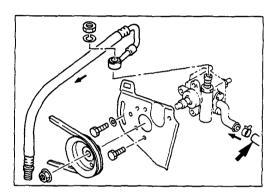
#### POWER STEERING HYDRAULIC LINE

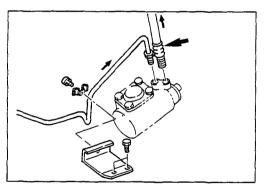


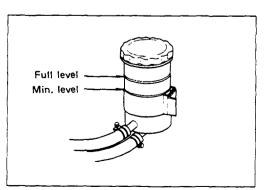
#### STEERING LINKAGE



# **SERVICING**







#### **POWER STEERING FLUID**

#### **Draining**

- Jack up the front wheels until they are clear of the ground.
- 2. Disconnect the fluid pipes between the steering unit and the fluid reservoir, and the fluid hose between the pump and the fluid reservoir.
- When draining is completed, remove remaining fluid within hydraulic system by turning the steering wheel to stop in both directions several times.



#### Refilling

- Connect the fluid lines securely and fill the fluid reservoir with specified automatic transmission fluid.
- When the fluid reservoir is filled to the specified level, allow 2 or 3 minutes. While refilling, keep fluid reservoir replenished as necessary to prevent air from entering the hydraulic system.
- 3. Lower the front wheels to the ground. Start and let the engine idle for a few minutes.

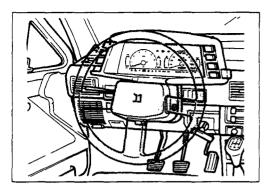
Recheck the fluid level and replenish if necessary.

Fluid Capacity

Liter(US pint/UK pint)

Approx. 1.0 (2.13/1.75)

Automatic transmission fluid (DEXRON®)



#### STEERING WHEEL PLAY



#### Inspection

1. Check the amount of the steering wheel play by turning the wheel in both directions until the tires begin to move with the front wheels properly in the straightahead position.

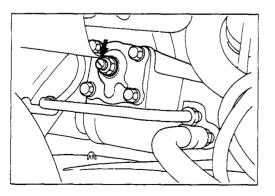


#### Note:

If the vehicle is equipped with a power steering unit, the wheel free play should be checked with the engine running.

Free Play mm(i		
Manual Steering	10-30 (0.4-1.2)	
Power Steering	10 (0.4)	

2. Also check the steering wheel for play and looseness in mount by moving it back and forth and sideways. While driving check for hard-steering, steering shimmy and tendency of steering to pull to one side.





### Adjustment

- 1. Align the front wheels properly in the straight ahead position.
- 2. Loosen the lock nut on the adjusting screw of the steering unit.
- 3. Turn the adjust screw clockwise to decrease free play or counter-clockwise to increase.
- 4. After check of specified free play, tighten the lock nut to specified torque.

Lock Nut Torque	kg·m(lb.ft/N·m)
Manual Steering	$2.5 \pm 0.5 \ (18.1 \pm 3.6/24.5 \pm 4.9)$
Power Steering	$4.2 \pm 0.6 (30.4 \pm 4.3/41.2 \pm 5.9)$

#### AIR BLEEDING

Fill fluid reservoir with specified automatic transmission fluid (DEXRON) and turn the steering wheel to lock in both directions repeatedly, so that level of fluid in the reservoir lowers.

Fill to bring the level of fluid in the reservoir to the specified level and start the engine.

Perform the following check with the engine running at idle.

Bleeding is considered to be completed if the following conditions apply;

- (1) Turn the steering wheel to lock in both directions 3 or 4 times.
  - A buzz is not produced in the hydraulic line.
- (2) Stop the engine with steering wheel in a straight-ahead position.

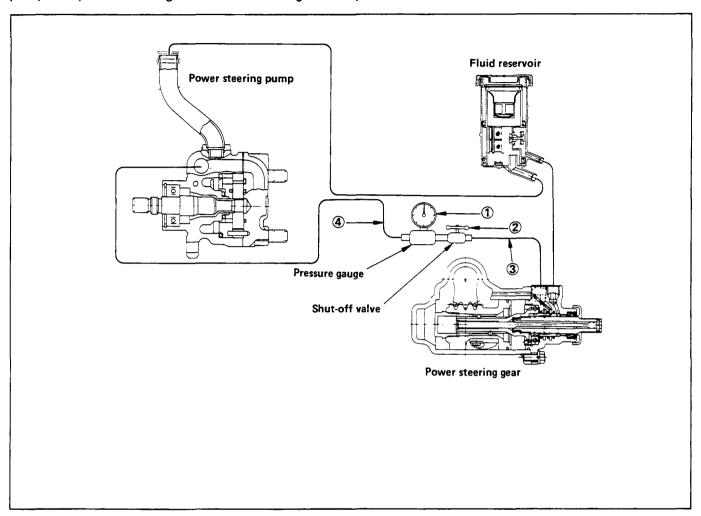
Level of fluid in reservoir does not increase.

#### Note:

Do not hold the steering wheel in position of lock for more than 5 seconds, or temperature of fluid increases sharply.

#### MEASUREMENT OF FLUID PRESSURE

Measurement of fluid pressure in the power steering system is performed to determine whether or not the oil pump and power steering unit are functioning normally.





#### 1. Installation of Tester

Power Steering Tester : 5-8840-0135-0 (J-29877-A)

Adapter; Power Steering Tester: 5-8840-0136-0 (J-33996)

- ① Oil Pressure Gauge with Shut Off Valve
- 2 Shut off Valve
- 3 Adapter (to steering unit)
- 4 Adapter (to oil pump)

#### Installation Procedure :

Disconnect the hose on the outlet side of the pump. Connect the gauge hose closest to the power steering gauge shut off valve to the hose on the vehicle. Connect the gauge hose furthest from the shut off valve to the outlet side of the power steering pump.

#### 2 Bleeding

- Open stop valve fully.
- Refer to air bleeding procedure.



- Open stop valve fully.
- Increase engine speed to 1500 rpm.
- Measure the fluid pressure when the steering wheel is turned to lock in both directions.

Fluid Pressure	kg/cm²(psi/kPa)
85 –	90
(1209 – 1280/	8336 – 8826)

#### Diagnosis:

- (1) When pressure is higher than Specified pressure, the valve within the oil pump is defective.
- (2) When the pressure is lower than Specified pressure.
  - Return steering wheel to straight-ahead position.
  - · Close stop valve completely.
  - Hold engine running at 1500 rpm, and take reading of the pressure gauge.

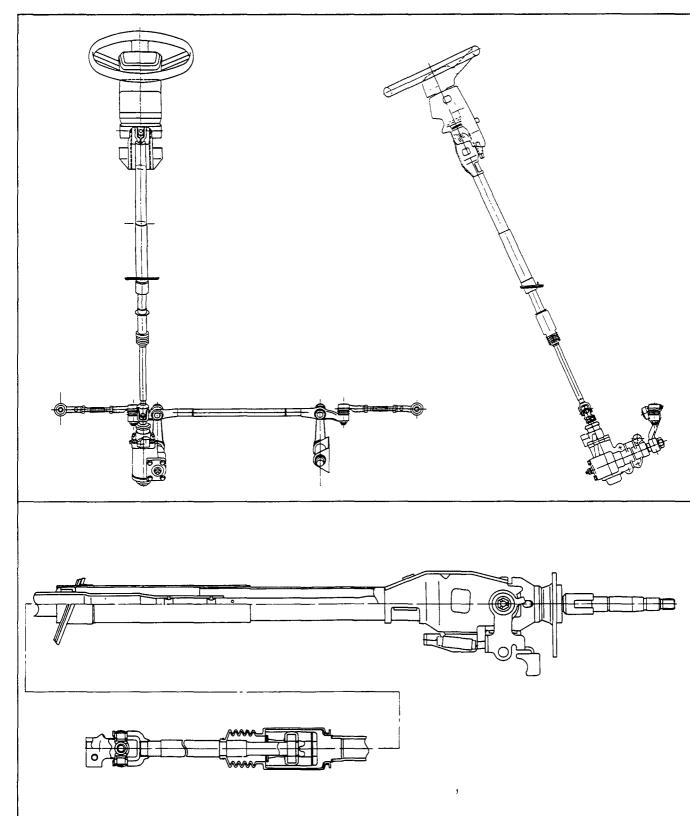
Fluid Pressure	kg/cm²(psi/kPa)	
	Possible trouble	
85 – 90 (1209 – 1208/8336 – 8826)	Steering unit	
Lower than 85 (1209/8336)	Oil pump	

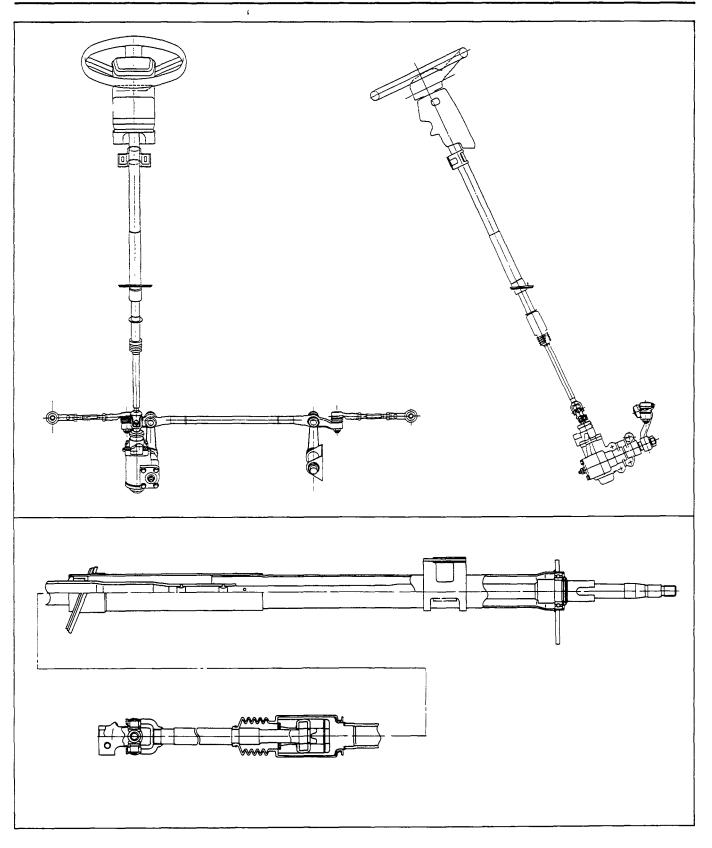


# **STEERING MECHANISM**

# **GENERAL DESCRIPTION**

## STEERING MECHANISM





The steering mechanism comprises a steering wheel, steering column, steering shaft, steering unit, and steering linkage.

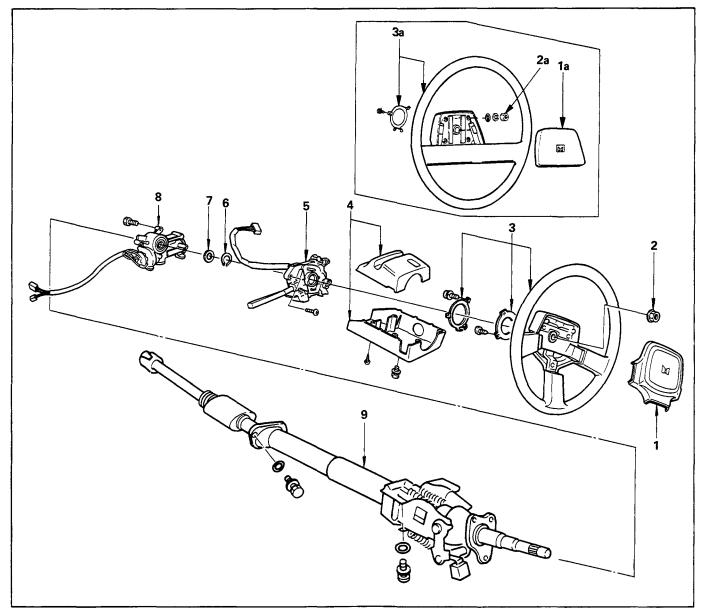
The steering shaft is equipped with slid joints to prevent vehicle vibration from transferring to the steering wheel.

# STEERING COLUMN



# **+**+

# **REMOVAL AND INSTALLATION**

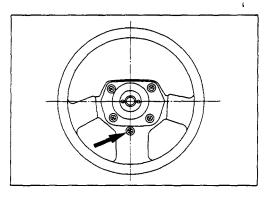


#### Removal Steps

- ▲ 1. Horn shroud
  - 2. Nut
- ▲ 3. Steering wheel
  - 4. Steering cowl
  - 5. Combination switch
  - 6. Snap ring
  - 7. Bushing
- 8. Steering lock and bearing
- ▲ 9. Steering column assembly

## **Installation Steps**

- ▲ 9. Steering column assembly
- ▲ 8. Steering lock and bearing
  - 7. Bushing
  - 6. Snap ring
  - 5. Combination switch
  - 4. Steering cowl
- 3. Steering wheel
- ▲ 2. Nut
- ▲ 1. Horn shroud

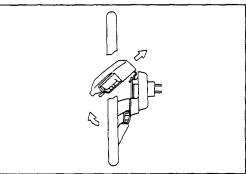




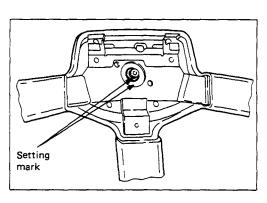
#### Important Operations - Removal

#### 1. Horn Shroud

(1) Remove the arrowed screw at the rear side of the steering wheel.



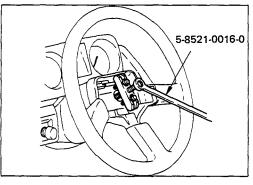
(2) Pull up the pad along the direction shown in the left figure and remove from the steering wheel.





#### 3., 3a. Steering Wheel

(1) Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



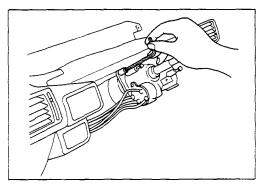


(2) Steering Wheel Puller: 5-8521-0016-0

(J-29752)

#### Note:

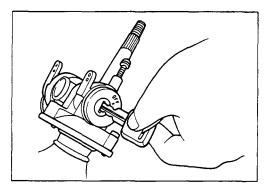
Never apply blow to the setting wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel, the setting shaft is designed as an energy absorbing unit.





#### 8. Steering Lock and Bearing

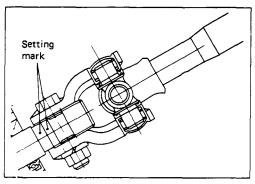
Remove the steering lock assembly using the inner hex wrench.



Turn the ignition key to OFF position.

#### Note:

With the steering in lock position, the steering lock assembly cannot be removed.



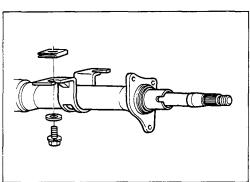


## 9. Steering Column Assembly

Apply a setting mark across the universal joint and steering shaft to reassemble of the parts in their original position.

#### Note:

A mating mark can be easily punched if the shaft is withdrawn a little by loosening the steering shaft universal joint.



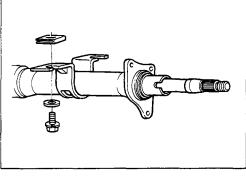


#### Important Operations — Installation

9. Steering Column Assembly Steering Column Torque

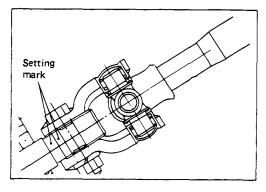
kg·m(lb.ft/N·m)

 $1.7 \pm 0.2 (12.3 \pm 1.4/16.7 \pm 2.0)$ 



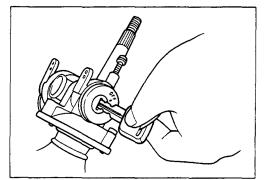


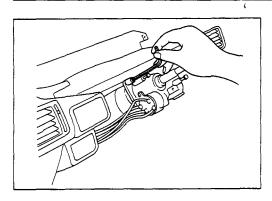
Align the setting marks made when removing.





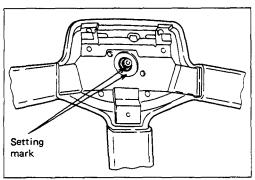
Turn the ignition key to OFF position. With the steering in lock position, the steering lock assembly cannot be installed.







Install the steering lock assembly using the inner hex wrench.



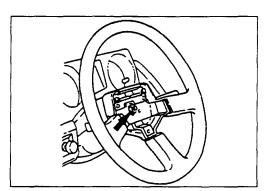


#### 3., 3a. Steering Wheel

- (1) Align the setting marks made when removing.
- (2) Apply grease to contact ring.

#### Note:

Never apply blow to the setting wheel in direction of the shaft by using a hammer or other impact tools in an attempt to install the steering wheel, the setting shaft is designed as an energy absorbing unit.



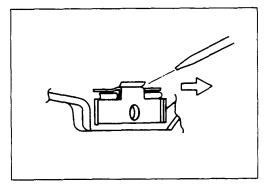


#### 2., 2a. Nut

Steering Wheel Nut Torque

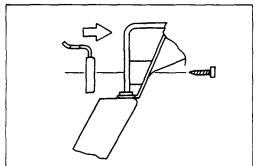
kg·m(lb.ft/N·m)

 $3.5 \pm 0.5 (25.3 \pm 3.6/34.3 \pm 4.9)$ 



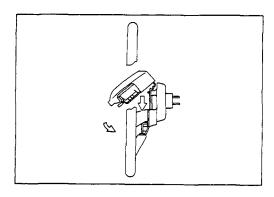
#### 1. Horn Shroud

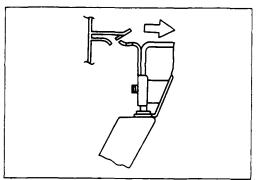
(1) Remove the bracket from the nail at the lower side of pad assembly with a screw driver.



(2) Install the bracket (removed at procedure 1) onto the steering wheel sub assembly with a screw.

#### 3B-20 STEERING



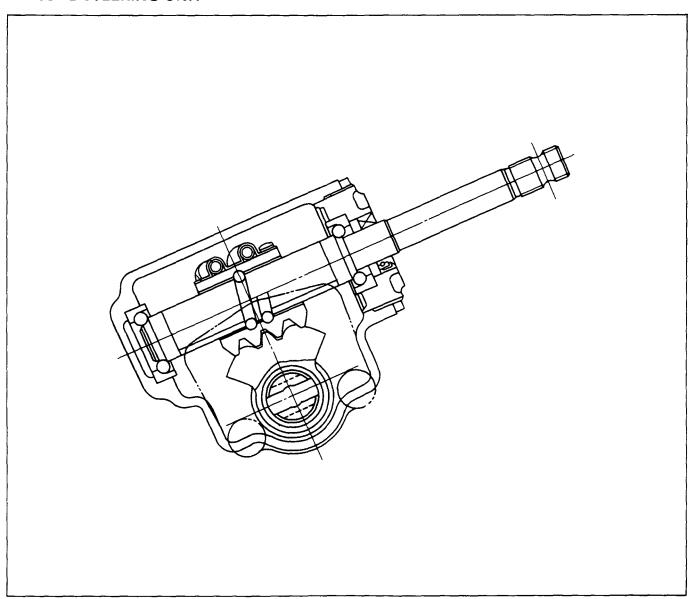


(3) Connect the harnesses, then, hang the nail of the pad assembly onto the plate of the steering wheel sub assembly, and install the pad carefully so that the nail is not separated from the bracket. (See the lowest figure.)

## STEERING UNIT

#### **GENERAL DESCRIPTION**

#### MANUAL STEERING UNIT



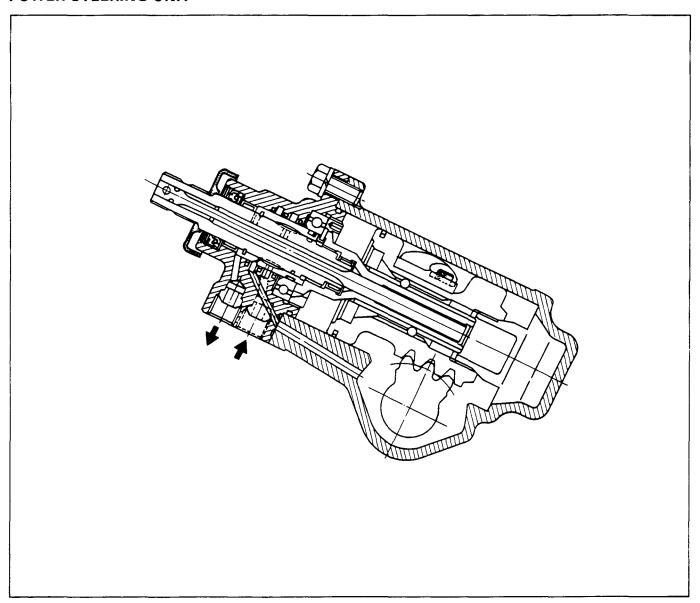
The steering gear is mainly comprised of the sector gear and the worm nut assembly.

There are many recirculating balls installed to the ball groove (way) between the worm nut and the steering worm shaft.

The steering gear's high mechanical efficiency provides very light steering.

Racks machined into the worm nut side face engage the fan shaped sector gear to transfer the steering wheel applied torque to the pitman arm.

#### POWER STEERING UNIT

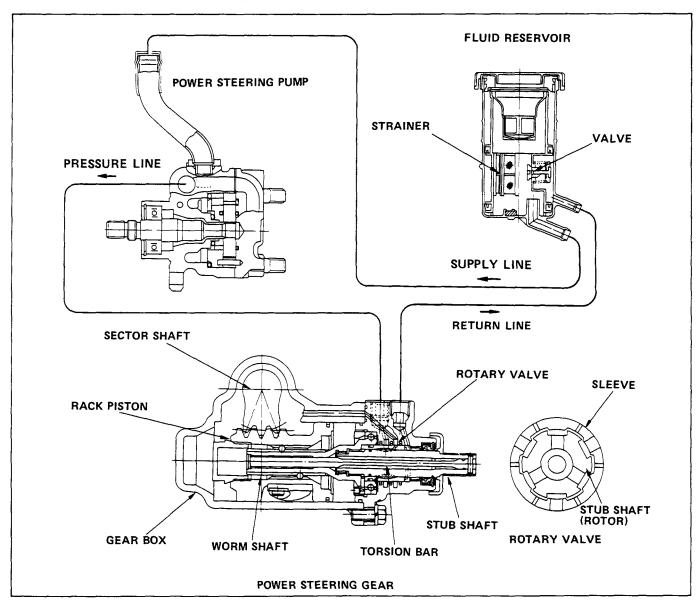


Power steering is designed to reduce the steering wheel turning effort by utilizing hydraulic pressure to bolster the normal torque developed by the steering wheel box.

The power steering unit incorporates a power piston and sector shaft as an integral part of the steering gear. A control valve is built into the steering housing.

Because the tire rolling resistance is constantly applied to the worm shaft, the torsion bar twists with the Steering Wheel. As the torsion bar twists, the relative torque displacement between the worm shaft and the rotor changes. An equivalent oil pressure is applied to the piston to bolster the normal torque.

# POWER STEERING HYDRAULIC LINE



The function of each major component is described below:

Power Steering Unit

Refer to the previous page.

#### Oil Pump

The oil pump uses the power of the engine to send hydraulic fluid to the power steering unit.

An oil pressure relief valve and an oil flow relief valve are installed to the oil pump.

The oil pressure relief valve prevents any excessive oil pressure from reaching the hydraulic circuit.

The oil flow control valve controls the hydraulic fluid volume within the hydraulic system. It prevents too much fluid from entering the system. This, in turn, prevents harmful heat build-up.

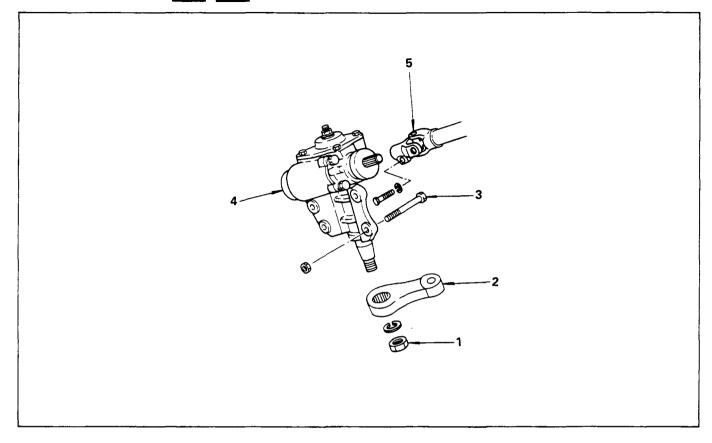
#### Oil Reservoir and Piping

The oil reservoir stores and filters the hydraulic fluid.





# **REMOVAL AND INSTALLATION**

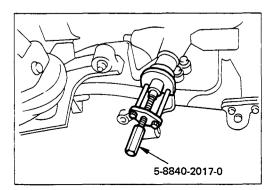


# **Removal Steps**

- 1. Nut
- ▲ 2. Pitman arm
  - 3. Bolt
  - 4. Unit assembly
- ▲ 5. Coupling assembly

# **Installation Steps**

- ▲ 5. Coupling assembly
  - 4. Unit assembly
- ▲ 3. Bolt
- ▲ 2. Pitman arm
- ▲ 1. Nut



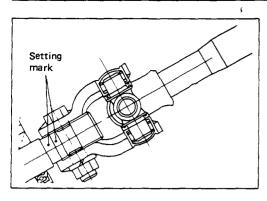


# Important Operations — Removal



## 2. Pitman Arm

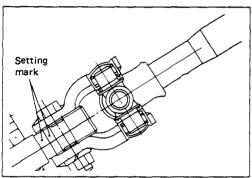
Pitman Arm Remover : 5-8840-2017-0





#### 5. Coupling Assembly

Make a setting mark across the coupling flange and worm shaft to ensure reassembly of the parts in the original position.





#### Important Operations - Installation

# 5. Coupling Assembly

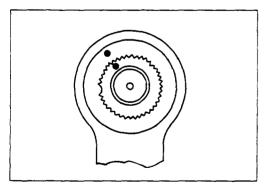
Align the setting mark made at removal



#### 3. Bolt

Steering Unit Bolt kg·m(lb.ft/N·m)

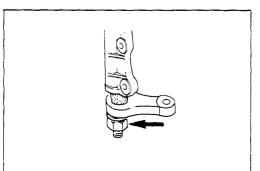
 $4.5 \pm 0.5 (32.5 \pm 3.6/44.1 \pm 4.9)$ 





#### 2. Pitman Arm

Align the notched tooth





#### 1. Nut

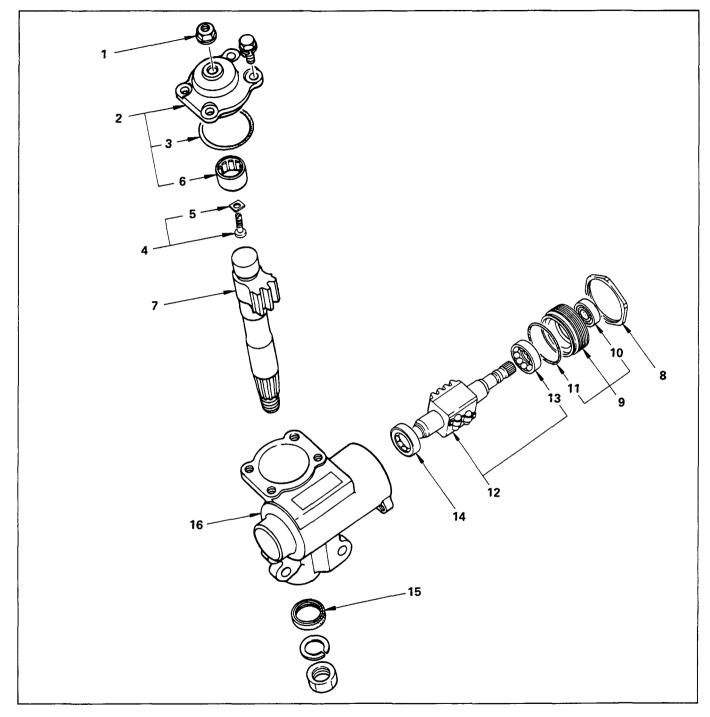
Pitman Arm Nut Torque kg·m(lb.ft/N·m)

 $22.0\pm2.0$  (159.1  $\pm14.5/215.8\pm19.6$ )

#### MANUAL STEERING UNIT



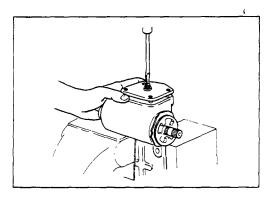
# **DISASSEMBLY**



# **Disassembly Steps**

- 1. Lock nut
- ▲ 2. Side cover
  - 3. Gasket
  - 4. Adjusting screw
  - 5. Adjusting shim
  - 6. Needle bearing
- ▲ 7. Sector shaft
- ▲ 8. Lock nut

- ▲ 9. End cover
  - 10. Oil seal
  - 11. O-ring
- ▲ 12. Ball nut and worm shaft
  - 13. Bearing
  - 14. Bearing
  - 15. Oil seal
  - 16. Gear box

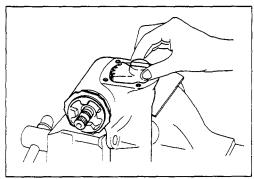




### **Important Operations**

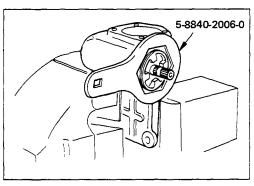
#### 2. Side Cover

- Turn the adjusting screw counter-clockwise slightly, then remove the side cover fixing bolt.
- (2) Turn the adjusting screw clockwise with the side cover held from turning.



#### 7. Sector Shaft

Hold the sector shaft in straight-ahead position when removing it from the gear box. Do not drive the sector shaft off the gear box with a hammer or other impact tools.

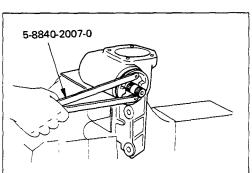




#### 8. Lock Nut

Lock Nut Wrench: 5-8840-2006-0

(J-29753)



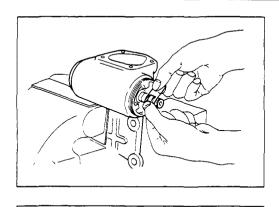


#### 9. End Cover

(1) End Cover Remover: 5-8840-2007-0

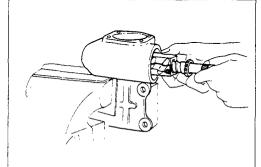
(J-7624)

#### 3B-28 STEERING



(2) When removing, take care so as not to damage the oil seal.

Taping the splines will provide some protection.



#### 12. Ball-Nut and Worm Shaft

Always keep ball-nut assembly in a horizontal position. Do not hold it vertically, or ball-nut will slide out.



# **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

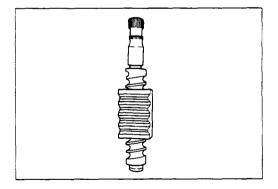


- · Oil seal, bushing
- . Ball-nut and worm shaft
- Sector shaft
- Gear box



#### Visual Check

Inspect the following parts for wear, damage or other abnormal conditions.

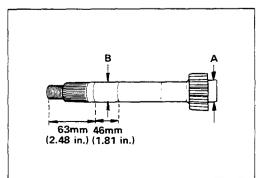


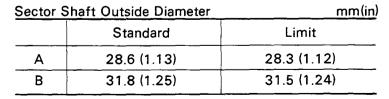
#### Ball-Nut Rotation

Hold the worm shaft vertically and check that the ball-nut lowers with a smooth turning motion. If the lowering of the ball-nut by its own weight is not smooth, check the worm shaft for bending and the ball-groove for burrs, dents, and foreign matter.

#### Note:

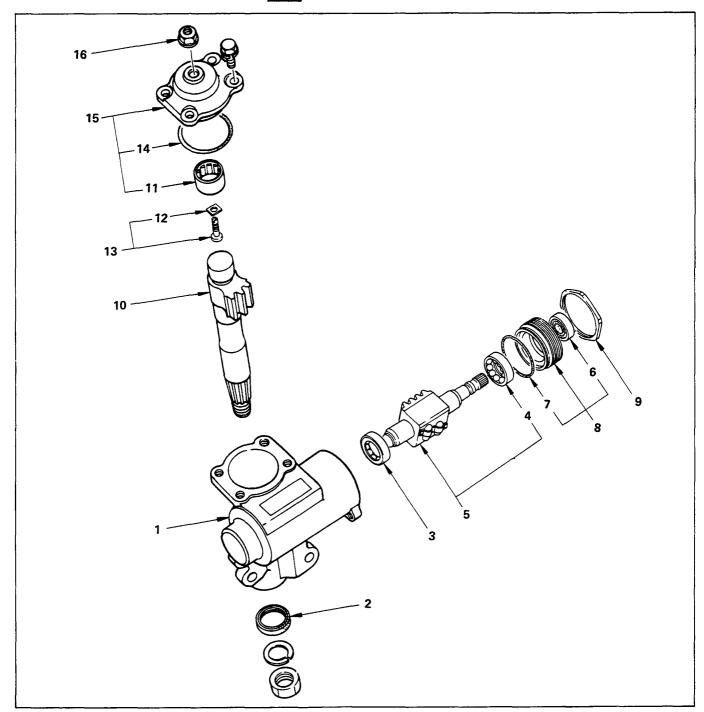
When testing the ball-nut assembly, do not let it travel all the way to the end of worm shaft, or damage to the ball tubes will result.







# **REASSEMBLY**

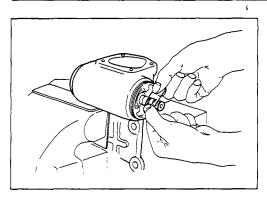


# **Reassembly Steps**

- 1. Gear box
- 2. Oil seal
- 3. Bearing
- 4. Bearing
- 5. Ball nut and worm shaft
- 6. Oil seal
- 7. O-ring

8. End cover

- 9. Lock nut
- ▲ 10. Sector shaft
  - 11. Needle bearing
- ▲ 12. Adjust shim
- 13. Adjust screw
- ▲ 14. Gasket
- ▲ 15. Side cover
- ▲ 16. Lock nut



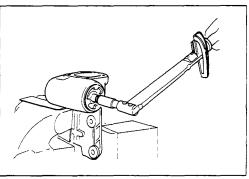


#### **Important Operations**

#### 8. End Cover

(1) When installing, take care so as not to cause damage to the oil seal.

Taping the splines will provide some protection.

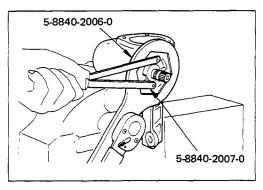




(2) Adjust the bearing preload by using socket.

Bearing Preload  $kg \cdot m(lb.ft/N \cdot m)$ 

0.03 - 0.06 (0.22 - 0.43/0.29 - 0.59)





#### 9. Lock Nut

Lock Nut Torque

kg·m(lb.ft/N·m)

 $18.0 \pm 2.0 \ (130.2 \pm 14.5/176.5 \pm 49.0)$ 



Lock Nut Wrench: 5-8840-2006-0

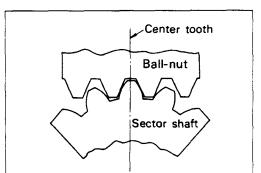
(J-29753)

End Cover Installer: 5-8840-2007-0

(J-7624)

Note:

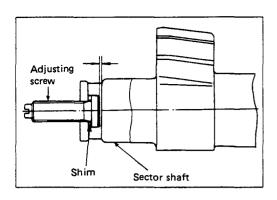
After tightening, check the bearing preload.





## 10. Sector Shaft

Align the center tooth of the ball-nut with that of the sector shaft.

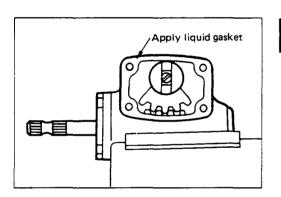




#### 12. Adjust Shim

Adjust the clearance and check that the adjusting screw

mm(in)
mm(in)

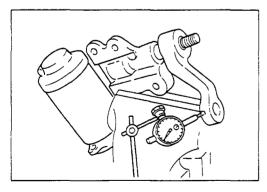




#### 14. Gasket

#### 15. Side Cover

Apply liquid gasket to the joining surface of each parts.





#### 16. Lock Nut

Adjust the backlash between the sector gear and ball-nut.

- (1) Install the pitman arm.
- (2) Check that the sector shaft moves smoothly in the correct working angle range, then semi-tighten the lock nut.



(3) Measure preload of worm gear.

Preload		kg·m(lb.ft/N·m)	
	less than 0.11 (0	.795/1.079)	

#### Note:

Obtain the specified backlash by turning the adjust



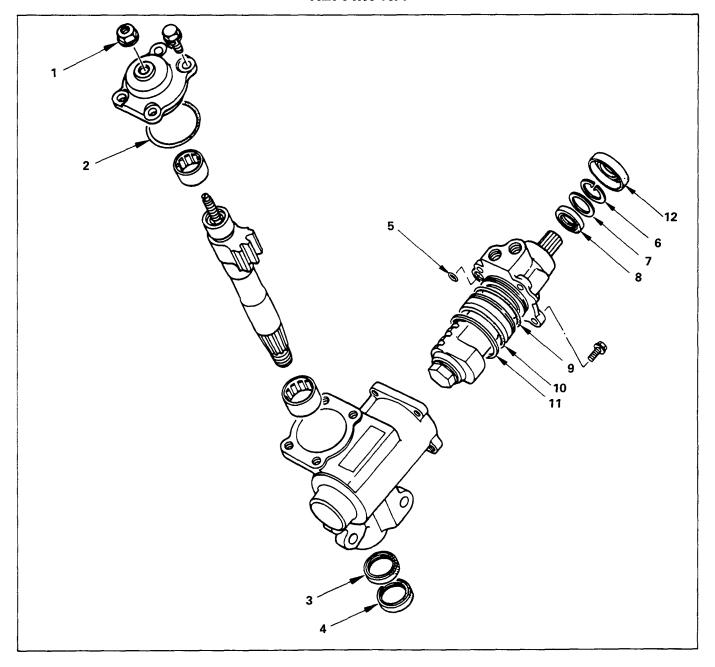
The backlash should be measured at the drop arm end.

Backlash mm(in)

0.2 (0.008)

# **POWER STEERING UNIT**

# **REPAIR KIT**



1. Nut: adjust screw

2. Gasket : cover

3. Gasket: sector shaft

4. Seal : sector shaft

5. Gasket: housing

6. Ring: retaining

7. Ring: back up

8. Seal : oil

9. Gasket: housing

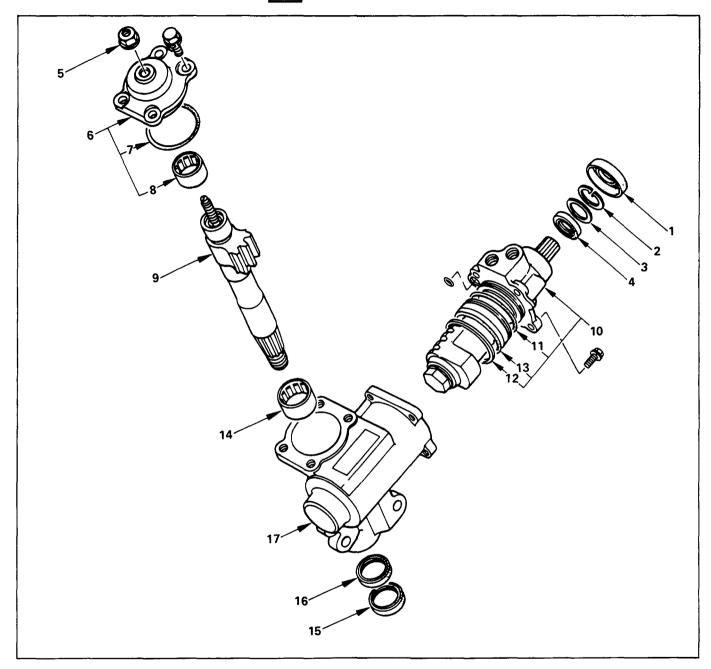
10. Gasket: housing

11. Seal ring: housing

12. Dust Cover

# DISAS:

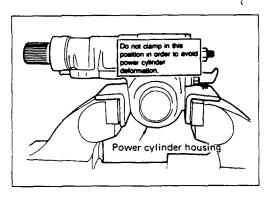
# **DISASSEMBLY**



# **Disassembly Steps**

- 1. Dust cover
- 2. Retaining ring
- 3. Back up ring
- ▲ 4. Oil seal
- ▲ 5. Lock nut
- ▲ 6. Top cover assembly
  - 7. O-ring
  - 8. Needle bearing
- ▲ 9. Sector shaft

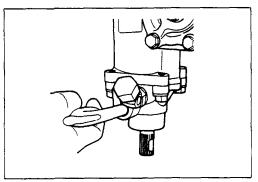
- ▲ 10. Ball nut and valve housing assembly
  - 11. Gasket
  - 12. Seal ring
  - 13. Gasket
  - 14. Needle bearing
  - 15. Sector shaft seal
  - 16. Sector shaft gasket
  - 17. Gear box





## **Important Operations**

Avoid clamping the steering gear assembly in a vise by the power cylinder housing.



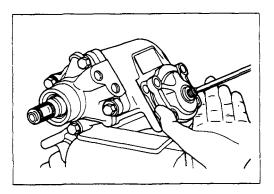


#### 4. Oil Seal

- (1) Clean the faces of the extended stub shaft.
- (2) Plug the hose fitting on the inlet side.
- (3) Remove the oil seal by blowing compressed air through the hole in the outlet side.

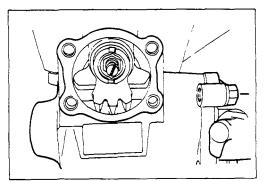
#### 5. Lock Nut

Remove the adjusting screw lock nut and turn the adjusting screw counter-clockwise to remove the preload between the sector gear and the rack piston, then remove the top cover bolts.



#### 6. Top Cover

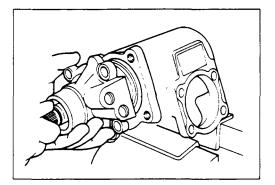
Hold the top cover stationary, turn the adjusting screw clockwise to raise and free the cover, then remove the cover.





#### 9. Sector Shaft

Bring the stub shaft into straight-ahead position. Do not force the sector shaft off the gear box with a hammer or other impact tools.



### 10. Ball Screw and Valve Housing Assembly

It is strongly advisable to keep the ball nut and valve housing assembly always in a horizontal position, or the rack piston will fall off onto the end of the worm, causing the rack piston to slip out of the worm shaft and the balls to fall out.



# INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

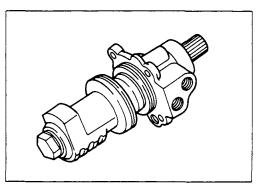


- Oil seal, Dust seal, Dust cover
- O-Ring, seal ring
- . Ball nut and valve housing
- Sector shaft
- Gear box



### Visual Check

Inspect the following parts for wear, damage or other abnormal conditions.

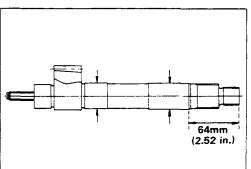


# **Ball-Nut Rotation**

Hold the ball nut and valve housing assembly vertically and see if the ball-nut lowers by turning smoothly. If the lowering of the ball-nut by its own weight is not smooth, check the worm shaft for bending and the ball-groove for burrs, dents and foreign matter.

#### Note:

When testing the ball nut and valve housing assembly, do not let it travel all the way to the end of worm shaft, or damage to the ball tubes will result.

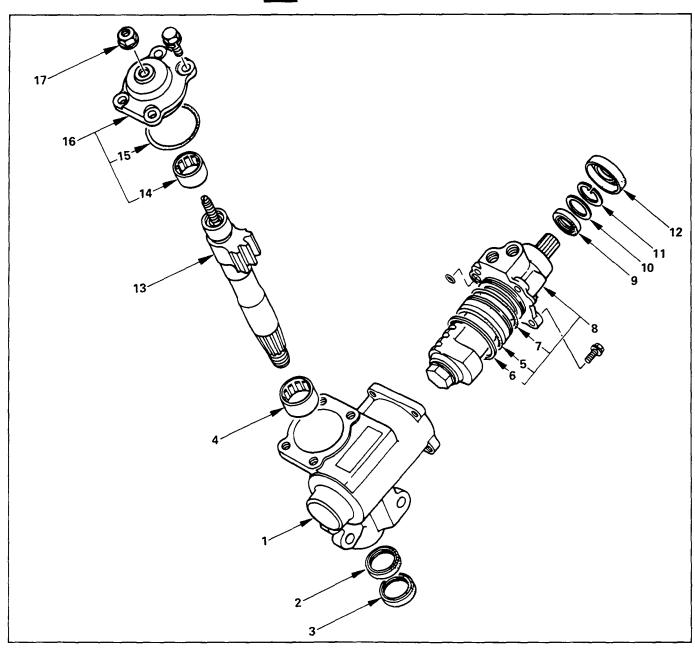




### Sector shaft outside diameter

	mm(in)
Standard	Limit
32.0 (1.260)	31.97 (1.258)

# **REASSEMBLY**

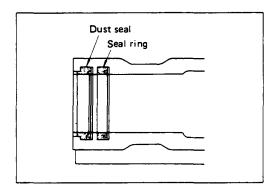


# **Reassembly Steps**

- 1. Gear box
- 2. Gasket
- Seal
  - 4. Needle bearing
- 5. Gasket
- 6. Seal ring
- 7. Gasket
- 8. Ball nut and valve housing assembly 

  17. Lock nut
- ▲ 9. Oil seal

- ▲ 10. Back up ring
- ▲ 11. Retaining ring
  - 12. Dust cover
- ▲ 13. Sector shaft
  - 14. Needle bearing
  - 15. O-ring
- ▲ 16. Top cover assembly





### **Important Operations**

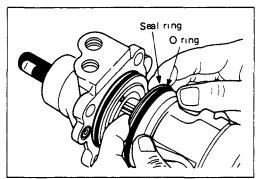


- 2. Seal Ring
- 3. Dust Seal



Note the setting direction.

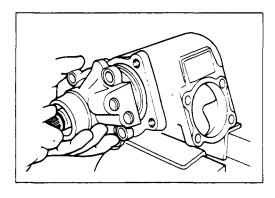
Apply a thin coat of grease to lip of each part.





- 5. O-Ring
- 6. Seal Ring
- 7. O-Ring

Apply a thin coat of grease.





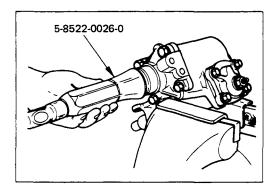
### 8. Ball Nut and Valve Housing Assembly

- (1) It is strongly advisable to keep the ball screw and valve housing assembly always in a horizontal position and avoid holding it vertically, or the rack piston will fall off onto the end of the worm, causing the rack piston to slip out of the worm shaft and balls to fall out.
- (2) Be carefull so as not to the drop the O-ring fitted to oil passage in the valve housing.
- (3) Tighten the valve housing retaining bolts to the specified torque.

Valve Housing Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $4.7\pm0.7$  (34 $\pm5.1/46\pm7.8$ )





9. Oil Seal

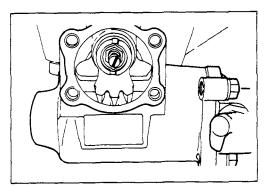
Oil Seal Installer: 5-8522-0026-0

(J-26508)

### 10. Back Up Ring

### 11. Retaining Ring

Turn the face with rounded edge (outer circumference) to the oil seal.





### 13. Sector Shaft

- (1) Tape the sector shaft serrations to protect the seal ring from damage.
- (2) Align the center tooth of ball nut with that of the sector shaft.

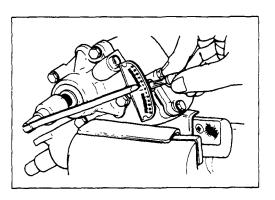


### 16. Top Cover Assembly

Top Cover Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $4.5\pm0.5$  (32.5±3.6/44.1±4)





### 17. Lock Nut

Adjust the backlash between the worm gear and the ball nut.

- (1) With the worm gear rotating, set it to the straight ahead position.
- (2) Set the worm shaft backlash to below 10 kg-cm with the sector shaft adjusting screw.
- (3) Measure the worm shaft backlash with the worm gear turned 450° both to the right and to the left.

The worm gear backlash in these positions should be 2 - 4 kg-cm lower than in the straight ahead position.



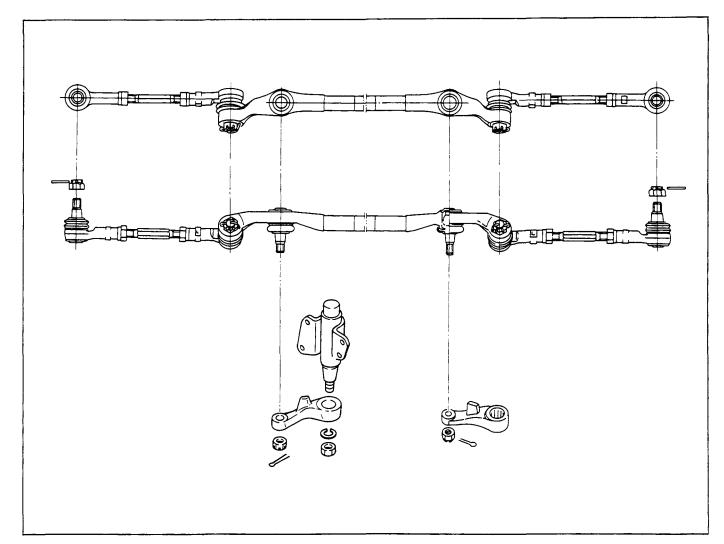
(4) Lock the sector shaft adjusting screw with the lock nut.

Lock Nut Torque

kg·m(lb.ft/N·m)

# STEERING LINKAGE

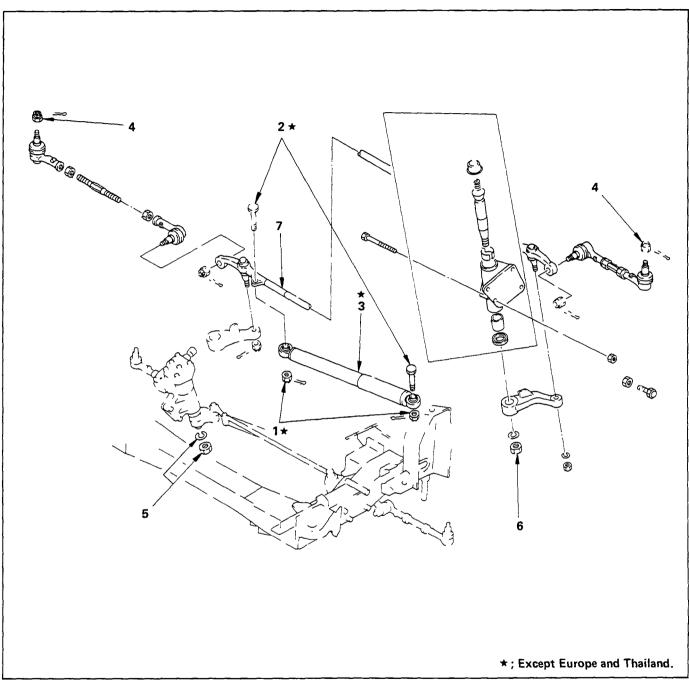
# **GENERAL DESCRIPTION**





# + |

# **REMOVAL AND INSTALLATION**

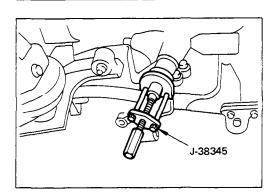


# **Removal Steps**

- 1. Nut
- 2. Boit
- 3. Steering damper
- 4. Nut
- ▲ 5. Nut; pitman arm
- ▲ 6. Nut; relay lever
- ▲ 7. Intermediate rod

# Installation Steps

- 7. Intermediate rod
- 6. Nut; relay lever
- ▲ 5. Nut; pitman arm
  - 4. Nut
  - 3. Steering damper
- 2. Bolt
- ▲ 1. Nut



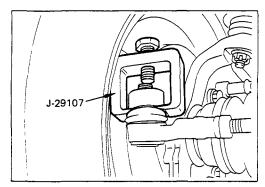


# Important Operations - Removal

5., 6. Pitman Arm Nut and Relay Lever Nut

Remove relay lever or pitman arm to shafts nut and lock washer. Remove the relay lever or pitman arm from the shaft using remover.

Remover: 5-8840-2017-0 (J-38345)





### 7. Outer Track Rod

Remove split pin from the ball stud connecting outer track rod end. Remove the castellated nuts and disconnect the parts using remover.

Tie Rod Remover: 5-8840-2121-0 (J-29107)



# Important Operations — Installation

6. Nut; Relay Lever

Relay Lever Nut Torque

kg·m(lb.ft/N·m)



# 5. Nut; Pitman Arm

Pitman Arm Nut Torque  $kg \cdot m(lb.ft/N \cdot m)$  $22.0 \pm 2.0 (159.1 \pm 14.5 \pm 215.8 \pm 19.6)$ 

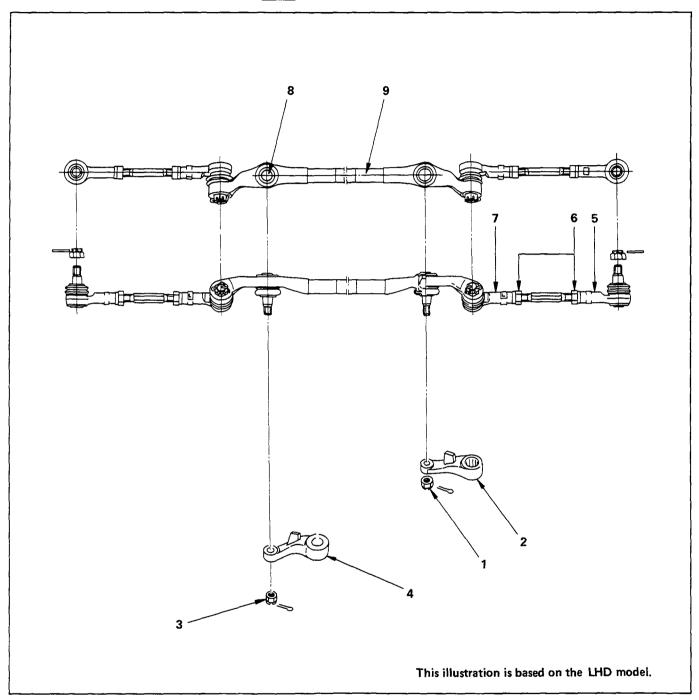


# 1. Nut

kg·m(lb.ft/N·m) Steering Damper Torque  $4.0\pm0.5$  (28.9  $\pm3.6/39.2\pm4.9$ )

 $12.0 \pm 1.0 (86.8 \pm 7.2/117.7 \pm 9.8)$ 

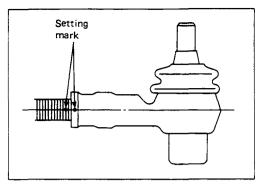
# DISASSEMBLY



# **Disassembly Steps**

- 1. Nut
- 2. Pitman arm
- 3. Nut
- 4. Relay lever
- ▲ 5. End assembly (outer)

- 6. Nut
- ▲ 7. End assembly (inner)
  - 8. Pin assembly
  - 9. Center track rod assembly



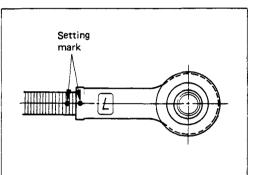


# **Important Operations**



### 5. End Assembly (Outer)

Apply the setting mark to reassemble the parts in their original position.





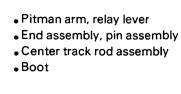
### 7. End Assembly (Inner)

Apply the setting mark to reassemble the parts in their original position.



# **INSPECTION AND REPAIR**

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.





### **Visual Check**

Inspect the following parts for wear, damage or other abnormal conditions.



# Ball Joints (Center Track Rod Assembly and Outer Track Rod Track Rod Assembly)

Inspect the following.

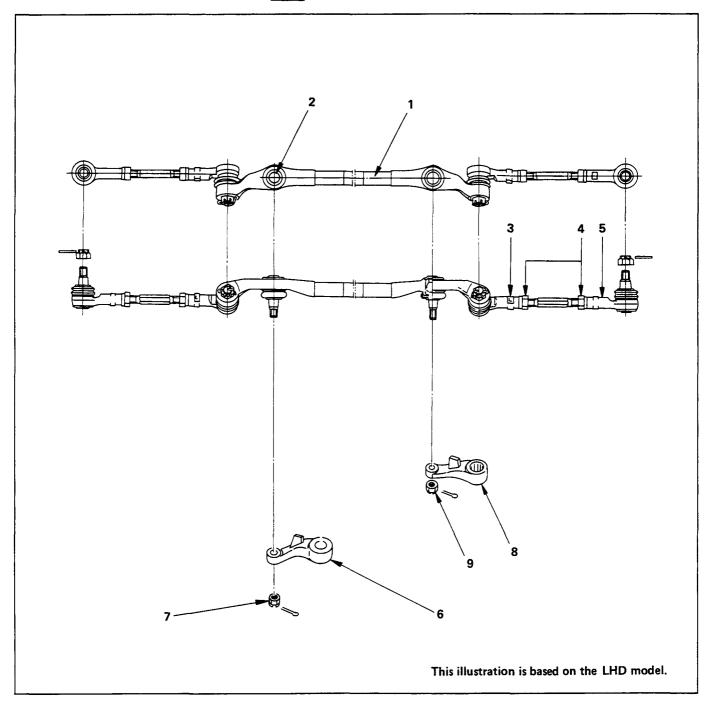
If one or more of the abnormal conditions listed in parenthesis is discovered during inspection, the entire track rod assembly(s) must be replaced.

- Ball joint boot (Tearing and grease leakage)
- 2. Ball joint (Rough movement)

The ball joint must move sommthly with no snagging.

- 3. Ball joint screws (Excessive damage)
- 4. Ball joint tapered surfaces (Excessive wear and damage)

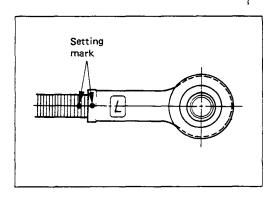
# REASSEMBLY



# **Reassembly Steps**

- 1. Center track rod assembly
- 2. Pin assembly
- ▲ 3. End assembly (inner)
- ▲ 4. Nut
- ▲ 5. End assembly (outer)

- 6. Relay lever
- 7. Nut
- 8. Pitman arm
- 9. Nut





# Important operations



### 3. End Assembly (Inner)

Align the setting marks applied at the disassembly.

End Assembly Torque

kg·m(lb.ft/N·m)

 $12.0 \pm 2.0 (86.8 \pm 14.5/117.7 \pm 19.6)$ 

After tightening, stake the two portions securely.

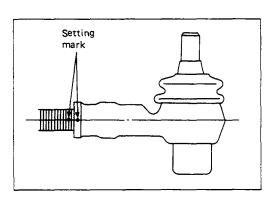


### 4. Nut

End Assembly Nut Torque

kg·m(lb.ft/N·m)

 $10.0 \pm 1.0 (72.3 \pm 7.2/98.1 \pm 9.8)$ 





### 5. End Assembly (Outer)

Align the setting marks applied during disassembly.



### 7. Nut

Relay Lever Nut Torque

kg·m(lb.ft/N·m)

 $6.0\pm0.5$  (43.4  $\pm3.6/58.8\pm4.9$ )

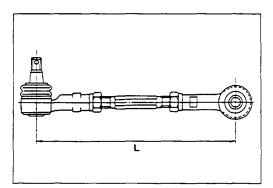


### 9. Nut

Pitman Arm Nut Torque

kg·m(lb.ft/N·m)

 $10.0 \pm 1.0 (72.3 \pm 7.2/98.1 \pm 9.8)$ 



### Note:

When change the track rod, adjust the track rod length.

mm(in)

4 x 2	$306.9 \pm 1.5 (12.08 \pm 0.059)$
4 x 4	262 $\pm$ 1.5 (10.31 $\pm$ 0.059)

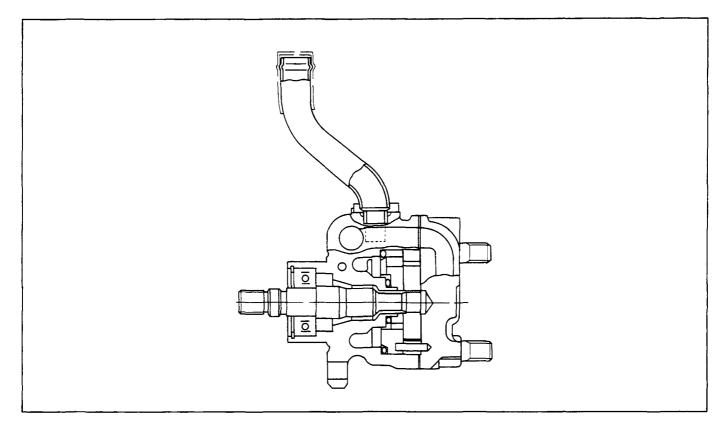


### **ADJUSTMENT**

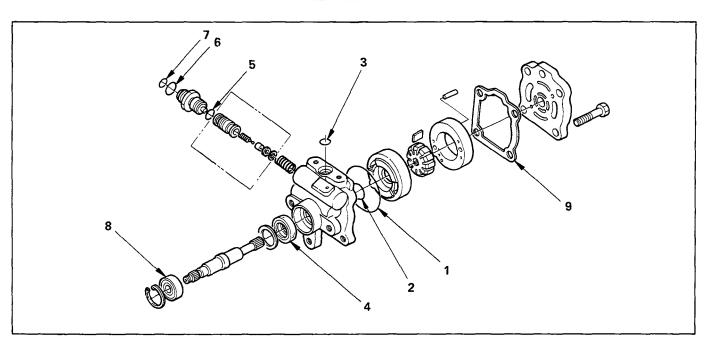
Adjust the toe-in angle.

# **POWER STEERING OIL PUMP**

# **GENERAL DESCRIPTION**



# **REPAIR KIT**



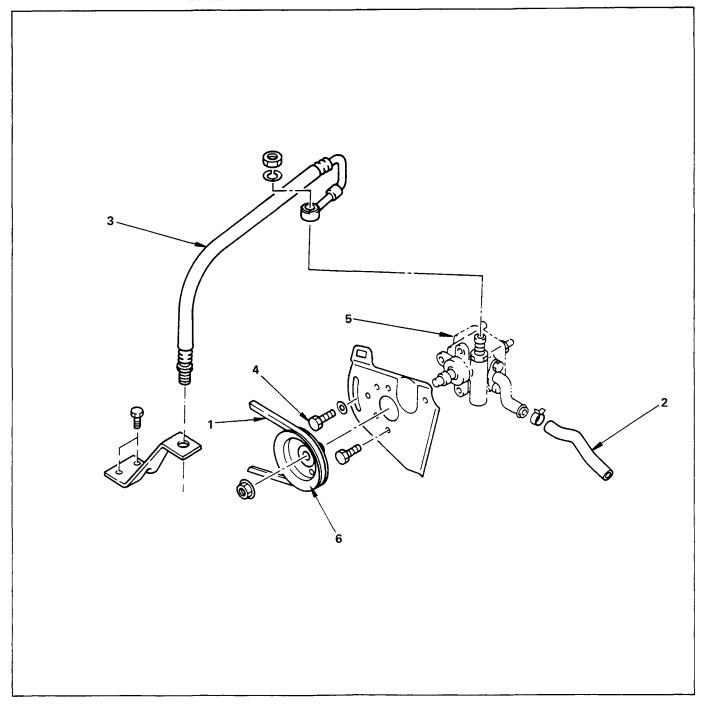
- 1. O-ring
- 2. O-ring
- O-ring
   Oil seal
- 5. O-ring

- 6. O-ring
- 7. O-ring
- 8. Bearing
- 9. Gasket





# **REMOVAL AND INSTALLATION**



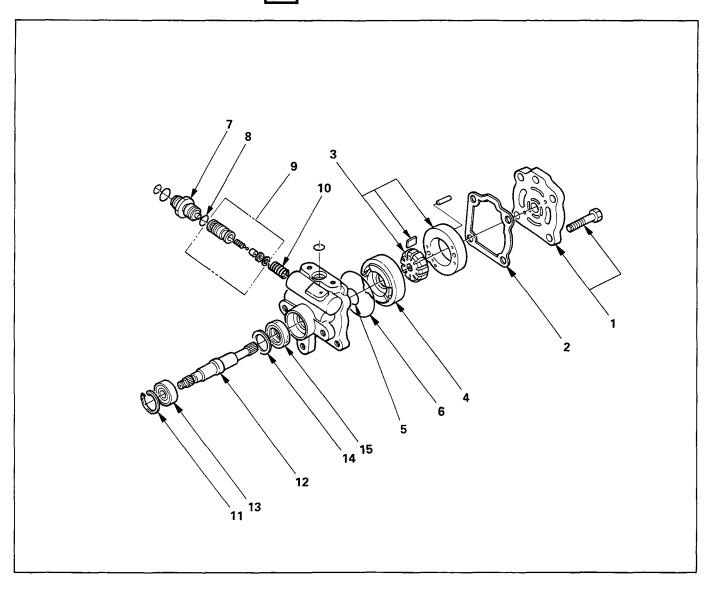
# **Removal Steps**

- 1. Belt : oil pump
- 2. Hose: rubber, suction
- 3. Hose: flexible
- 4. Bolts
- 5. Pump assembly : oil6. Pulley : oil pump

# **Installation Steps**

To install follow the removal procedure in reverse order

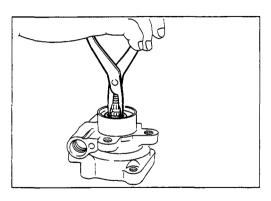
# DISASSEMBLY



# **Disassembly Steps**

- 1. Cover and bolt
- 2. Gasket
- 3. Cartridge assembly
- 4. Pressure plate
- 5. O-ring
- 6. O-ring
- 7. Connector
- 8. O-ring

- 9. Flow control valve assembly
- 10. Spring
- ▲ 11. Snap ring
- ▲12. Shaft
- ▲ 13. Bearing
  - 14. Retaining ring
- ▲ 15. Oil seal



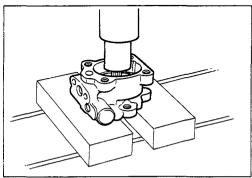


# **Important Operations**



### 11. Snap Ring

Use a pair of snap ring pliers to remove the snap ring.



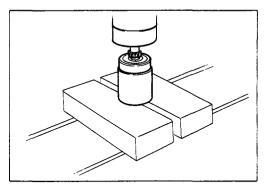


### 12. Shaft

Use a bench press to slowly force the shaft from the rear cover side.

### Note:

Take care not to damage the end of the shaft when removing the shaft.





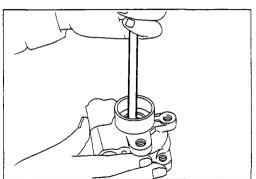
# 13. Bearing

Use the bench press and bearing remover.

Bearing Remover: 5-8840-2206-0

### Note:

Take care not to damage the shaft when removing the shaft.





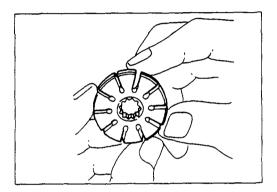
### 15. Oil Seal

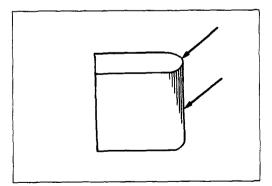
Use a suitable bar.



# INSPECTION AND REPAIR

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.





#### Rotor

Check that the groove in the vane is free from excessive wear and that the vane slides smoothly.

When part replacement becomes necessary, the pump cartridge should preferably be replaced as a sub assembly.

### Vane

Sliding faces of the vane should be free from wear. (particularly the curved face at the tip in contact with the cam should be free from wear and distortion.)

When part replacement becomes necessary, the pump cartridge should preferably be replaced as a sub assembly.

#### Cam

The inner face of the cam should have a trace of uniform contact without a sign of step wear.

When part replacement becomes necessary, the pump cartridge should preferably be replaced as a sub assembly.

### Pressure Plate and Thrust Plate

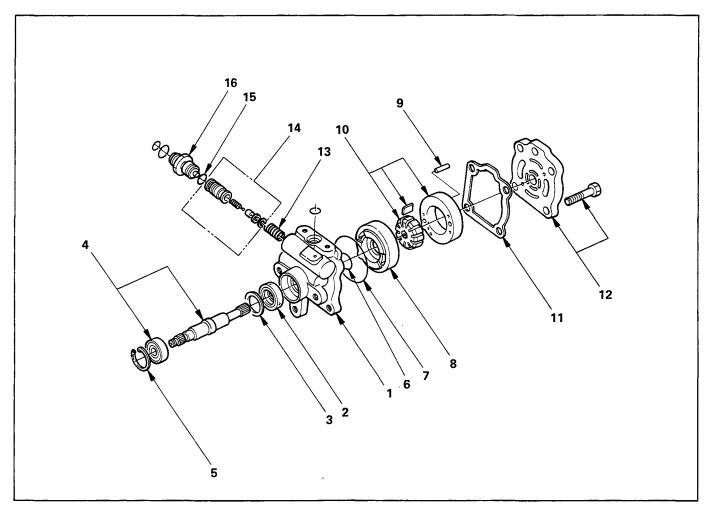
The sliding faces of the parts must be free from step wear (more than 0.01 mm) which can be felt by the finger nail.

The parts with minor scores may be reused after lapping the face.

#### Shaft

Oil seal sliding faces must be free from a step wear which can be felt by the finger nail.

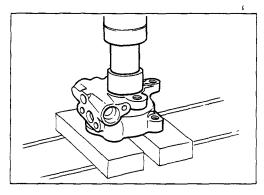




# **Reassembly Steps**

- 1. Body assembly
- ▲ 2. Oil seal
  - 3. Retaining ring
- ▲ 4. Shaft and bearing
- ▲ 5. Snap ring
  - 6. O-ring
  - 7. O-ring
  - 8. Pressure plate

- 9. Pin
- ▲ 10. Cartridge assembly
  - 11. Gasket
- ▲ 12. Cover and bolt
  - 13. Spring
  - 14. Flow control valve assembly
  - 15. O-Ring
- ▲16. Connector

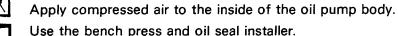




### **Important Operations**

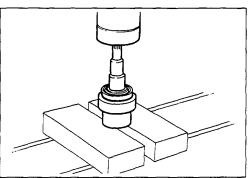


### 2. Oil Seal





Oil Seal Installer: 5-8840-2205-0

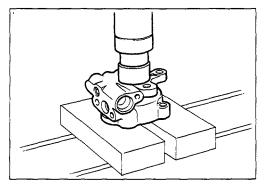




### 4. Shaft and Bearing

Install the bearing to the shaft with a bench press and bearing installer.

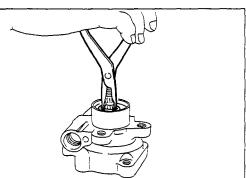
Bearing installer: 5-8840-2206-0





Use a bench press and bearing installer to slowly farce the shaft from front side of the oil pump body.

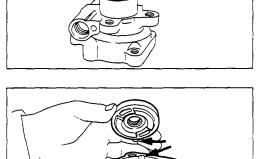
Bearing Installer: 5-8840-2206-0





### 5. Snap Ring

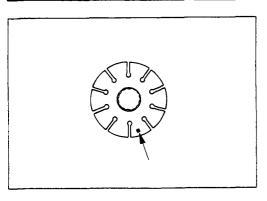
Use a pair of snap ring pliers to install the snap ring.





### 8. Pressure Plate

When installing the pressure plate, align the projection of pressure plate with the grove of oil pump body.

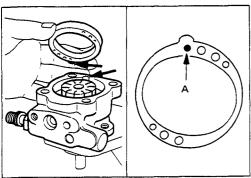




### Rotor

Place the rotor so that specified mark **u** turns down.

When part replacement becomes necessary, the pump cartridge should be replaced as a sub assembly.

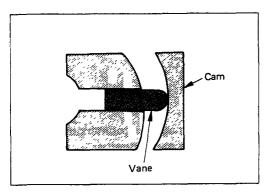




### Cam

When installing the cam, align the projection of cam with the grove of oil pump body.

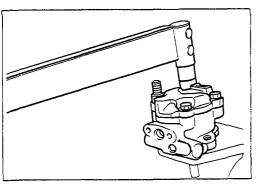
Install the cam with the pin "A" side turn down.





### Vane

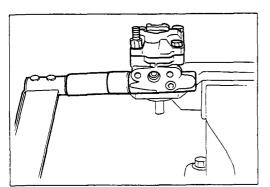
The round end of the vane should be matched to the inner surface of the cam ring.





### 12. Cover and Bolt

 $kg \cdot m(lb.ft/N \cdot m)$ Torque  $5.5 \pm 0.5 (39.8 \pm 3.6/53.9 \pm 4.9)$ 





### 16. Connector

 $kg \cdot m(lb.ft/N \cdot m)$ Torque  $5.5 \pm 0.5 (39.8 \pm 3.6/53.9 \pm 4.9)$ 

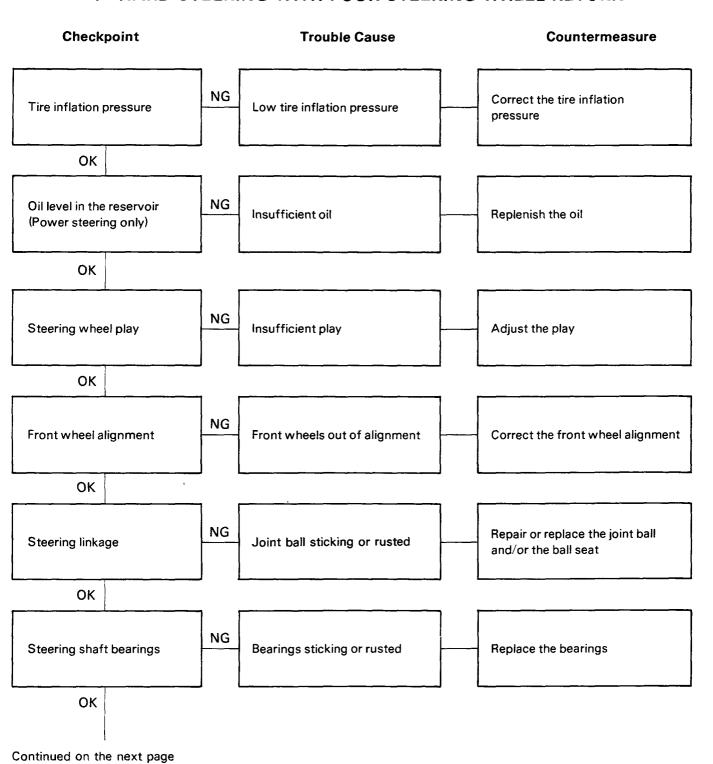
# **TROUBLESHOOTING**

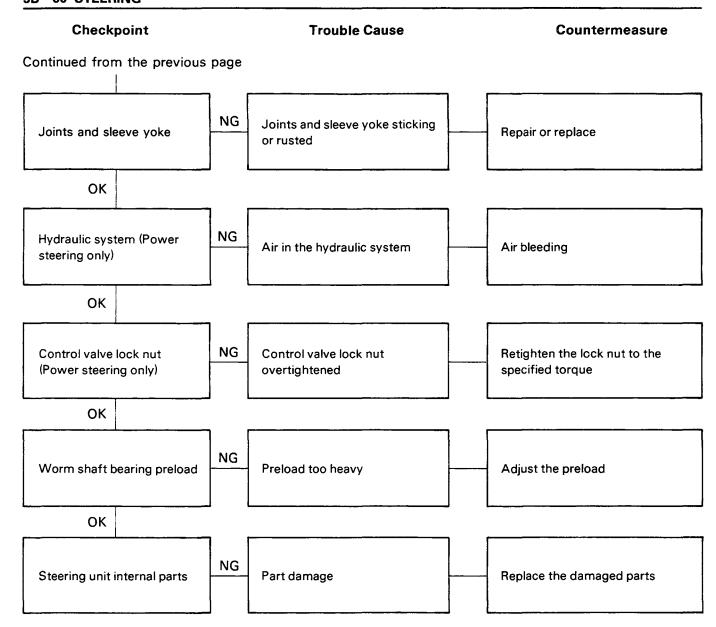
# INSPECTION PROCEDURES FOR STEERING SYSTEM

COMPONENT AND TEST		PROCEDURE		
HANDLE	Check for play and slack	<ol> <li>Place the steering wheel in the straight forward position. Gently move the wheel to the right and to the left. About ten millimeters of play in either direction should be present before the front tires begin to move. If the vehicle is equiped with power steering, the engine should be running when these tests are made.</li> </ol>		
		<ol><li>Grasp the steering wheel firmly with both hands. Exert force in an up and down direction on the steering column. There should be no play.</li></ol>		
		<ol> <li>Move the steering wheel to the right and to the left. Check to see the steering shaft.</li> <li>Make sure that there is no slack in those areas where parts are joined together.</li> </ol>		
	Check the operating condition of the system	<ol> <li>Make the following checks while actually driving the vehicle.</li> <li>a. Check the position of the steering wheel when the vehicle is traveling straight ahead.</li> <li>b. Make sure that the vehicle does not have a tendency to steer to the right or the left.</li> <li>c. There should be no excessive vibration present at the steering wheel.</li> <li>d. Turn the vehicle as sharply as possible to both the right and the left. When the steering wheel is turned fully in either direction, check for abnormal noise. Neither should the wheel feel overly heavy when it is fully turned to either the left or the right. Loosen your grip on the steering wheel. It should return to its center position.</li> </ol>		
GEAR BOX	Check for oil leakage	<ol> <li>Check all parts of the steering unit (the oil seals of the front cover, side cover, sector shaft, etc.) to make sure that there is no oil leakage.</li> </ol>		
	Check for looseness in the assembly	<ol> <li>With the wheels of the vehicle on the ground (the vehicle should not be jacked up), have an assistant or helper turn the steering wheel to the right and to the left. As he does this, you should carefully check all areas where the steering unit is attached to the frame for looseness and other possible problems.</li> </ol>		
	Check for bearing backlash	<ol> <li>Check the condition of the connections between the steering shaft and the bearings. Move the steering shaft in the direction of the axle and make sure that there is no backlash present.</li> </ol>		
		<ol> <li>Rotate the steering shaft. There should be no abnormal noise. It should rotate smoothly and there should be no feeling of roughness.</li> <li>Check to make sure that there is no abnormal or excessive bearing wear.</li> </ol>		
	Check for gear backlash	The front wheels should be facing straight ahead. Have an assistant or helper grasp the drop arm so as to immobilize it. Now try to turn the steering wheel. Backlash should not exceed one millimeter.		
	Inspect the sector shaft for cracks	Remove the steering unit from the vehicle and break it down into its component parts. Carefully inspect the sector shaft for cracks or other damage.		

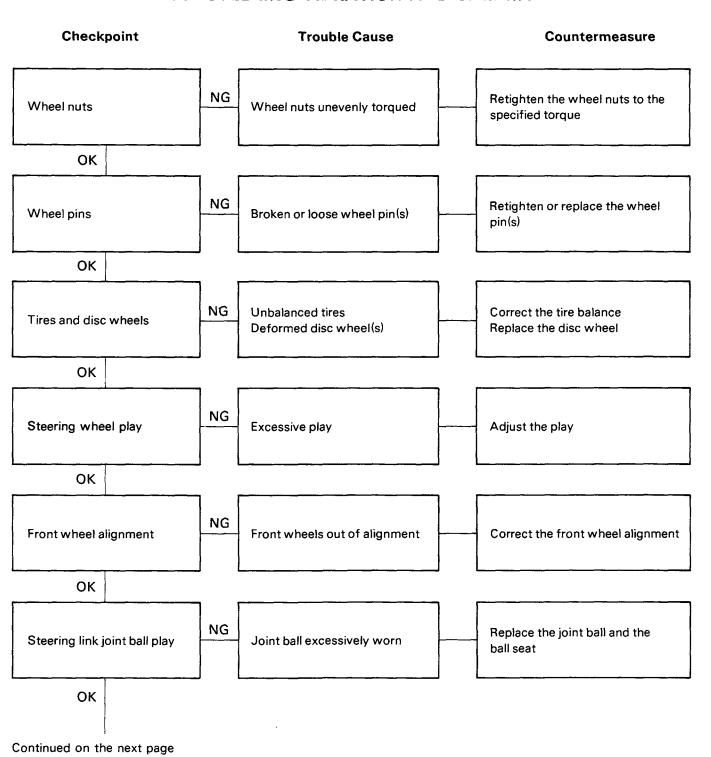
COMPONENT AND TEST		PROCEDURE		
RODS AND ARMS	Check for play, backlash, and damage	<ol> <li>With the wheels of the vehicle on the ground (the vehicle should not be jacked up), have an assistant or helper turn the steering wheel to the right and to the left. As he does this, you should carefully check the connecting points of all the parts for play, slack, or damage.</li> <li>a. Specifically check the pitman arm, the intermediate rod, the tie rods, the tie rod ends, the knuckle arms, and the relay lever.</li> </ol>		
		<ol><li>Carefully check all of the pins for cracks and other damage.</li></ol>		
		<ol> <li>Make sure that the rod end boots and related areas are not cracked or otherwise damaged.</li> </ol>		
	Check the coupling parts	<ol> <li>The ball joints and the rubber bushings should be free from abrasion or any other damage.</li> </ol>		
	for abrasion and other abnormal conditions	<ol> <li>Pay careful attention to the coupling areas. Make sure that everything is properly connected.</li> </ol>		
	Check for cracks in the knuckle arms and also for poor knuckle attachment	Make sure that both the knuckle arms and the tie rod arms are free from cracks.     The fit between the knuckles and the tapers should be secure.     Look for any abnormal coloring which may indicate trouble.		
KNUCK- LES	Check for loose and damaged joints	<ol> <li>Jack up the front axle and the front crosspiece. By hand, rotate the two front tires in either direction. Check that the king pins and the ball joints are free of play or slack.</li> <li>If play or slack is present, have an assistant or helper, hold down the brake pedal. Using a dial gauge, once again check the wheels for play and vibration. It is possible that the problem lies not with the steering system but with the wheel bearings.</li> </ol>		
	Check the gap between the steering knuckles and the front axle	<ol> <li>Use a thickness gauge or other appropriate tool to measure the width of the gap between the steering knuckles and the front axle. Measure in the direction of the king pin.</li> <li>After measurement, thrust washers may be inserted to alter the gap.</li> </ol>		

# 1. HARD STEERING WITH POOR STEERING WHEEL RETURN





# 2. STEERING VIBRATION AND SHIMMY



# Continued from the previous page

Faulty shock absorbers

**Trouble Cause** 

Replace the bearings

Replace the shock absorbers

Countermeasure

Wheel bearings

Shock absorbers

NG

NG

NG

Excessive clearance

Play in bearings excessive

or bearings disintegrated

Adjust the clearance

OK

Adjust screw and sector shaft clearance

OK

NG Sector shaft needle bearing

NG

Part damage

Needle bearing excessively worn Replace the needle bearing

Replace the damaged parts

OK

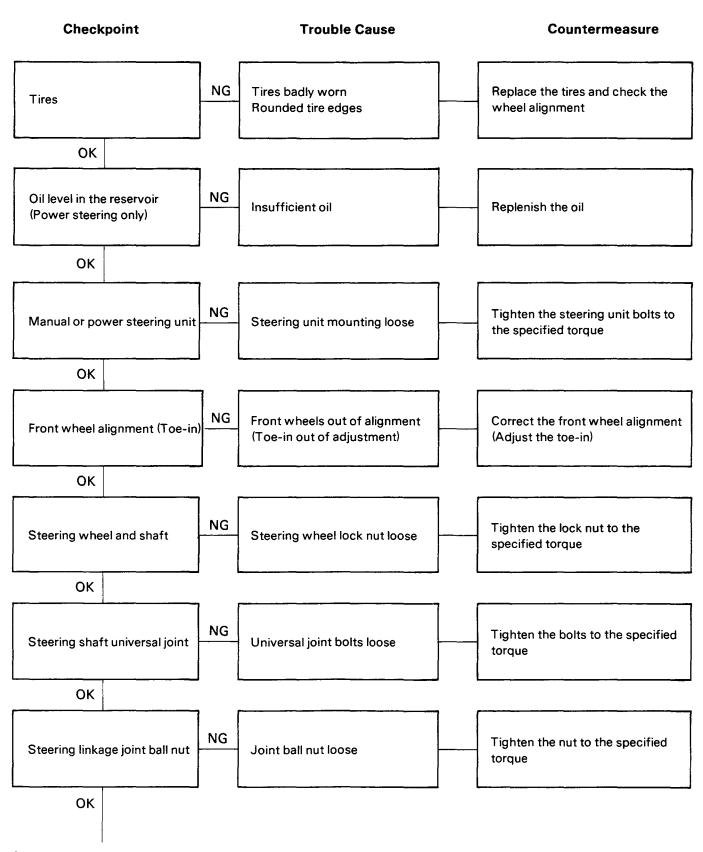
OK

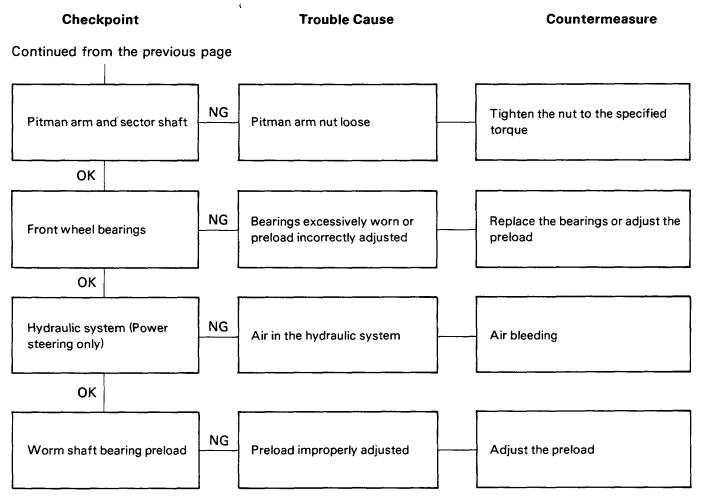
Steering unit internal parts

# 3. STEERING PULLS TO ONE SIDE OR THE OTHER

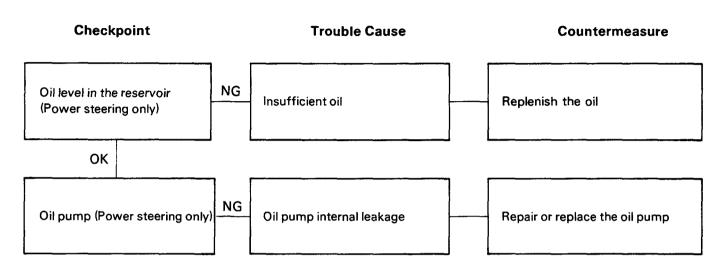
Checkpoi	nt	Trouble Cause	Countermeasure
Tire inflation pres	sure	Tires unevenly inflated	Inflate all the tires to the specified pressure
ОК			
Tires and disc wh	eels	Unbalanced tires Deformed disc wheel(s)	Correct the tire balance Replace the disc wheel
ОК			
Wheel bearings	NG	Incorrect preload or damage	Correct or replace
ОК	· · · · · · · · · · · · · · · · · · ·		
Shock absorbers	NG	Faulty shock absorbers	Replace the shock absorbers
ОК			
Front wheel align	ment	Front wheels out of alignment	Correct the front wheel alignment
ОК			
Brakes	NG	One wheel dragging	Refer to Section 05A "BRAKE VACUUM ASSISTED HYDRAULIC TYPE"
ОК			
Steering shaft en	d play	Excessive end play	Adjust the end play

# 4. STEERING WANDER (EXCESSIVE PLAY OR LOOSENESS)

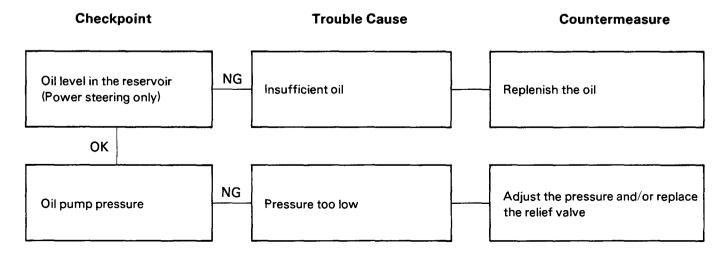




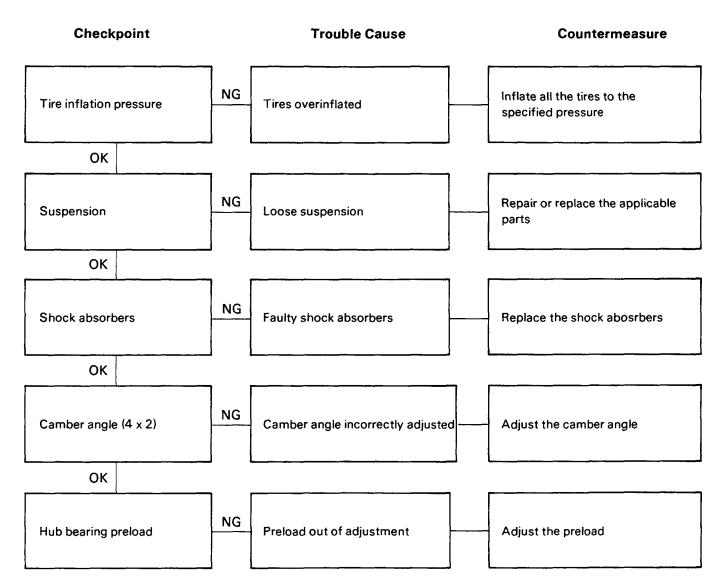
# 5. MOMENTARY INCREASE IN STEERING EFFORT WHEN THE STEERING WHEEL IS TURNED QUICKLY TO ONE SIDE OR THE OTHER (POWER STEERING ONLY)



# 6. STEERING WHEEL SURGE OR JERK WHEN PARKING THE VEHICLE (POWER STEERING ONLY)

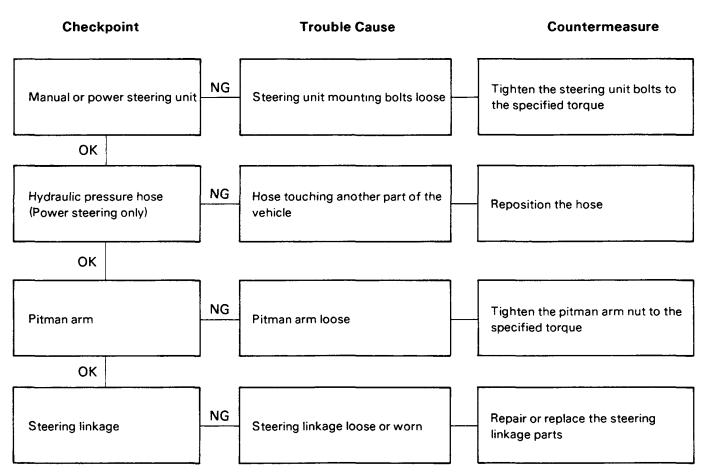


### 7. EXCESSIVE ROAD SHOCK

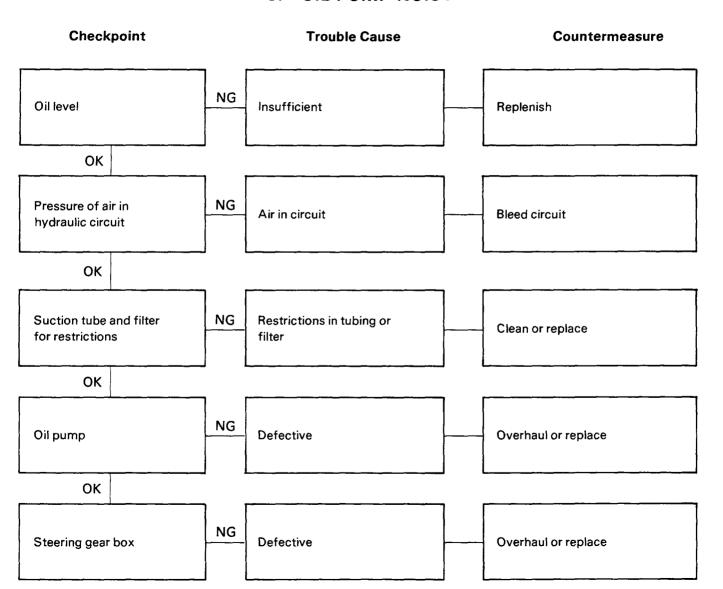


# 8. ABNORMAL NOISE

# (1) RATTLING OR CLICKING NOISE IN THE STEERING GEAR



# 9. OIL PUMP NOISY











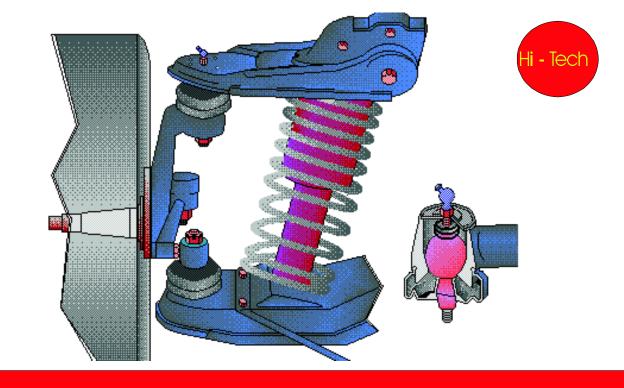


Torsion bar 4x2

Torsion Bar 4x4

Knuckle 4x2

Knuckle 4x4



# KB TF 140 Front Suspension

# SECTION 3C FRONT SUSPENSION

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## MAIN DATA AND SPECIFICATIONS

## 4 x 2 Model

Front Suspension Type		Independent wishbone arms. Torsion bar springs with stabilizer bar.		
		Short wheel base	Long wheel b	ase
			Except Flat Deck	Flat Deck
Front Wheel Alignment				
When not loaded	<i>a</i>		· (=0.00)	
Tread	mm(in)		5 (56.88)	
Camber			0' ± 60'	
Caster		*1°35' ± 45'	to be equal within 45') *1°50' ± 45' to be equal within 35'	*1°10' ± 45'
Toe-in	mm(in)	<del>-</del>	0.08 ± 0.08)	
Kingpin inclination	11111(111)		* ± 60'	
Torsion Bar Spring Data				
Petrol Engine Model (Exc	•		<b></b>	
Length x Diameter	mm(in)		(39.61 x 0.937)	
Wheel Rate/Side	kg/mm(lb/in/N/mm)	2.36 (1	132/23.14)	
Spring Constant	kg+m/deg(lb.ft/deg/N+m/deg)	100 /	4.45 (32.18/43.64)	
Spring Capacity	kg(lb/N)	430 (9	948/4217)	
Diesel Engine Model and				
Petrol Engine Model for Au	stralia			
Length x Diameter	mm(in)	1006 x 24.4	(39.61 x 0.961)	
Wheel Rate/Side	kg/mm(lb/in/N/mm)		143/25.0)	
Spring Constant	kg-m/deg(lb.ft/deg/N-m/deg)		5.44/48.0 <sup>6</sup> )	
Spring Capacity	kg(lb/N)	475 (1047/4658), For	Australia 525 (1157/514	8)
Shock Absorber Data				
Maximum Length	mm(in)	325	(12.80)	
Minimum Length	mm(in)		(8.27)	-
Stroke	mm(in)		5 (4.53)	
Damping Force	` '		,	
Rebound Side		240 kg a	t 0.3 m/sec.	
		(2400 N a	at 0.3 m/sec.)	
Compression Side		70 kg a	t 0.3 m/se.	
		(700 N a	t 0.3 m/sec.)	
Shock Absorber Data (Fo	r Australia)			
Maximum Length	mm(in)	328 (1	2 91)	_
Minimum Length	mm(in)	213 (	· · · · · · · · · · · · · · · · · · ·	
Stroke	mm(in)	115 (		
	11111(111)	110 (-	¬)	_
Damping Force Rebound Side		045 144	at 0.2 m/aca	
Hebouria Side		•	at 0.3 m/sec.	
Compression Side			ec./2108 N at 0.3m/sec.	<u>'</u>   —
Compression Side			at 0.3 m/sec. sec./1157 N at 0.3m/sec.	1
		(20.0 ib. at 11.0 ln/s	ec./115/ Natu.sm/sec.	

## 4 x 4 Model

Front Suspension Type		Independent wishbone arms Torsion bar springs with stab	
_		Short wheel base	Long wheel base
Front Wheel Alignment When not loaded Tread Camber	mm(in)	1438 (; 0°30'	± 60'
Caster  Toe-in	mm(in)	(Left and right side to *1°55' ± 45'   * Left and right side to 2 ± 2 (0.0 10° ±	*2°50' ± 45' o be equal within 35' 8 ± 0.08)
Kingpin inclination		E UI	
Torsion Bar Spring Data Length x Diameter Wheel Rate/Side Spring Constant Spring Capacity	mm(in) kg/mm(ib/in/N/mm) kg•m/deg(lb.ft/deg/N•m/deg) kg(lb/N)	998 x 23.4 (3 3.33 (18 4.20 (30 Petrol engine 50 Diesel engine 5	36/32.6) 3.4/41.2) 30 (1102/4903),
Shock Absorber Data Type Maximum Length Minimum Length Stroke Damping Force Rebound Side  Compression Side	mm(in) mm(in) mm(in)	Hydraulic double : 375 (1 235 () 140 () 240 kg at () (2400 N at () 70 kg at ()	4.76) 9.25) 5.51) 0.3 m/sec. 0.3 m/sec.) 0.3 m/se.
Shock Absorber Data (Fo Type Maximum Length Minimum Length Stroke Damping Force Rebound Side  Compression Side	mm(in) mm(in) mm(in) mm(in)	Gas-sealed, hydraulic doub 377 (14.84) 237 (9.33) 140 (5.51) 200 kg at 0.3 r (441 lb. at 11.8 in/sec./1961 138 kg at 0.3 r (304 lb. at 11.8 in/sec./1353	m/sec. I N at 0.3m/sec.) m/sec.

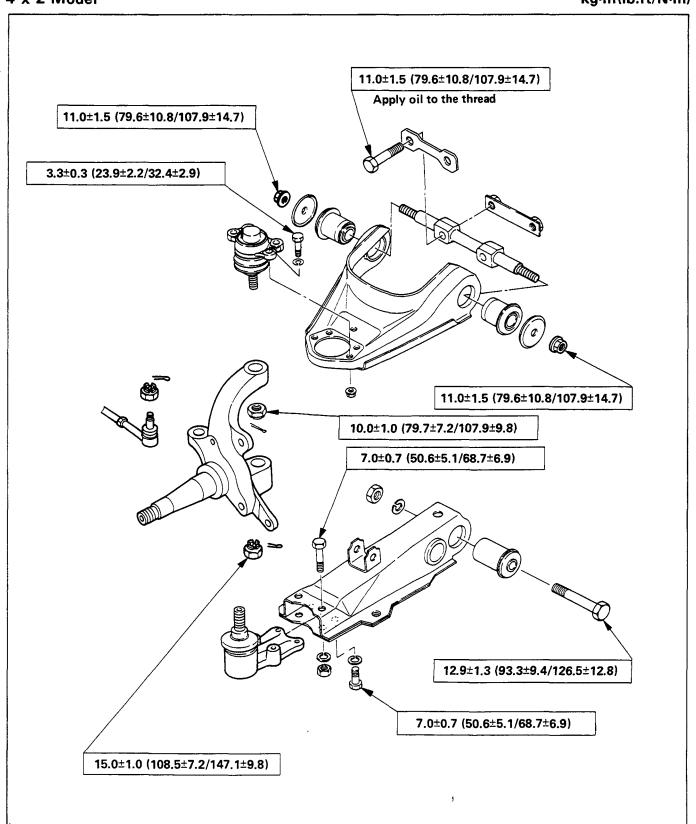
## **TORQUE SPECIFICATIONS**



## SPECIAL PARTS FIXING NUTS AND BOLTS

#### 4 x 2 Model

kg·m(lb.ft/N·m)



kg·m(lb.ft/N·m) 4 x 2 Model 2.0±0.5(14.5±3.6/19.6±4.9) 1.0 (7.2/9.8) 8.4±0.8 (60.8±5.8/82.4±7.8) 13.0±1.3 (94.0±9.4/127.5±12,8) 2.5±0.5 (18.1±3.6/24.5±4.9) 7.0±0.7 (50.6±5.1/68.7±6.9) 1.9±0.5 (13.7±3.6/18.6±4.9)

10.0±1.0 (72.3±7.2/98.1±9.8) 10.5±1.0 (75.9±7.2/103.0±9.8) 20.0±2.0 (144.7±14.5/196.1±19.6) Apply oil to the thread 13.0±1.0 (94.0±7.2/127.5±9.8)

FRONT SUSPENSION 3C-7  $kg \cdot m(lb.ft/N \cdot m)$ 4 x 4 Model 2.8±0.7 (20.3±5.1/27.5±6.9) 2.0±0.5 (14.5±3.6/19.6±4.9) 4.1±0.6 (29.7±4.3/40.2±5.9) VIEWA

1.0 (7.2/9.8)

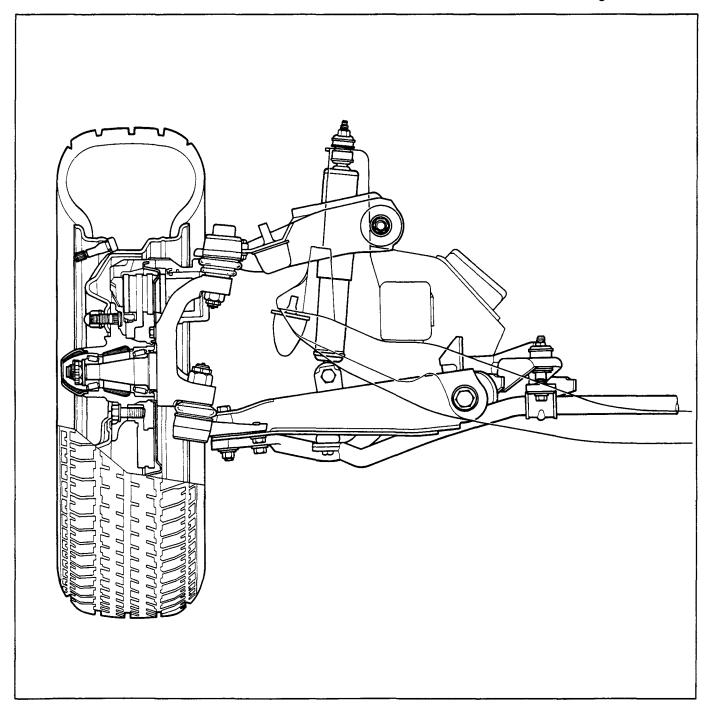
8.4±0.8 (60.8±5.8/82.4±7.8)

## FRONT SUSPENSION

## **GENERAL DESCRIPTION**

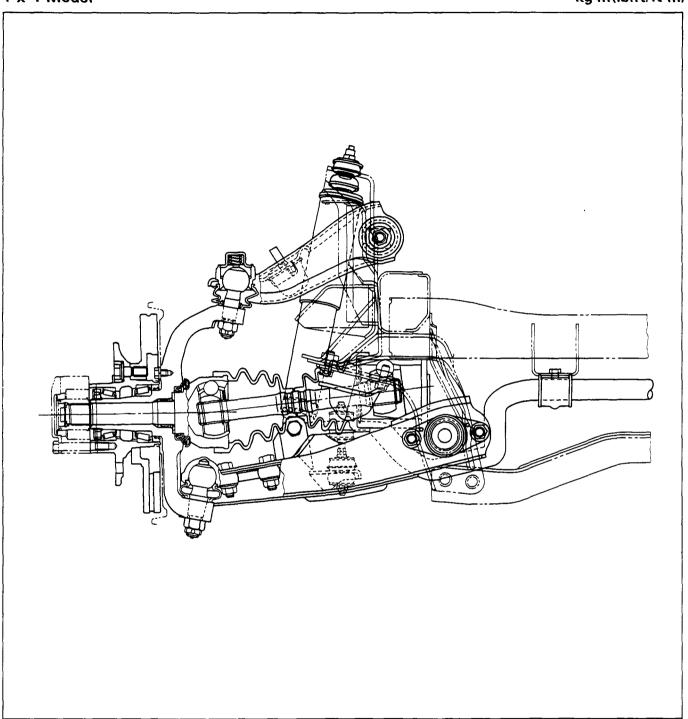
4 x 2 Model

kg·m(lb.ft/N·m)



4 x 4 Model

kg·m(lb.ft/N·m)



The links attach to the vehicle with bolts and bushings at their inner pivot points and to the steering knuckle, which is part of the front wheel spindle, at their outer points.

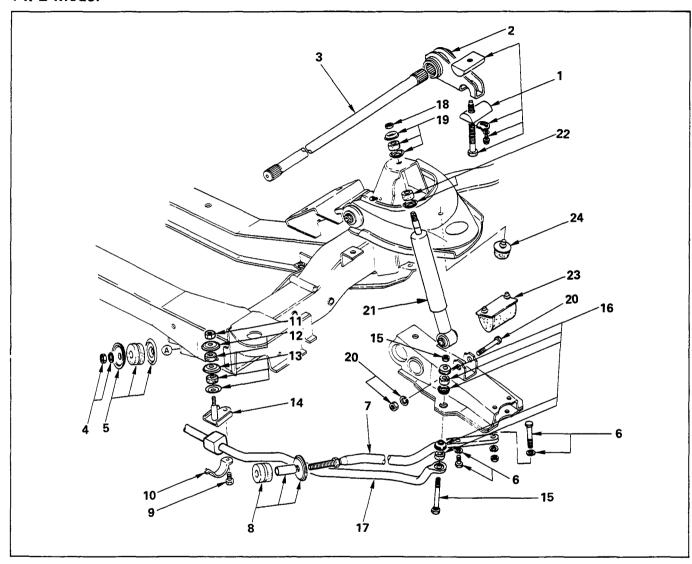
The knuckle is mounted to the upper and lower links each of which has a ball joint to permit pivoting of the knuckle for steering operation. The hub is supported in position on the knuckle spindle by means of the two bearings and the rotor is mounted to the hub.

The front suspension is an independent type utilizing torsion bar springs. The torsion bar spring has splines on each end. Height control is provided on the third crossmember. Both the upper and lower links are pressed steel and the torsion bar is supported at the ends by lower link in front and by height control arm in rear.

## TORSION BAR, STABILIZER BAR AND SHOCK ABSORBER

# DISASSEMBLY

#### 4 x 2 Model



## **Disassembly Steps**

#### **Torsion Bar**

- Adjust bolt, seat, lock plate and bolt
- ▲ 2. Height control arm
- 3. Torsion bar

#### **Strut Bar**

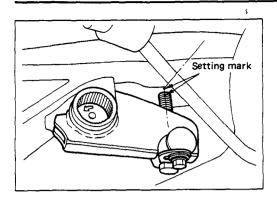
- 4. Nut and washer
- 5. Rubber bushing and washer
- 6. Bolt and washer
- 7. Strut bar
- 8. Rubber bushing, washer and tube

#### Stabilizer Bar

- 9. Bolt
- 10. Bracket
- 11. Nut
- 12. Rubber bushing and washer
- 13. Rubber bushing and washer
- 14. Bracket
- 15. Bolt and nut
- 16. Rubber bushing and washer
- 17. Stabilizer bar

#### Shock Absorber

- 18. Nut
- 19. Rubber bushing and washer
- 20. Bolt, nut, and washer
- ▲ 21. Shock absorber
  - 22. Rubber bushing and washer
  - 23. Lower link bumper
  - 24. Upper link bumper

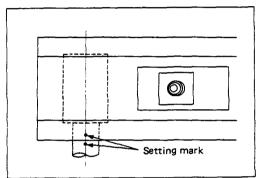




#### **Important Operations**

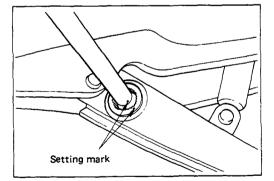
#### 1. Adjust Bolt

Apply the setting marks to the adjust bolt and height control arm.



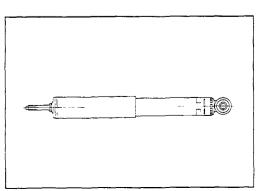
#### 2. Height Control Arm

Apply the setting marks to the height control arm and torsion bar.



#### 3. Torsion Bar

Apply the setting marks to the torsion bar and lower link.



## 21. Shock Absorber (For Australia)

#### **CAUTION:**

The shock absorbers have been charged with gas at the factory. Exposure to high temperatures or an open flame can result in a dangerous explosion.

Keep the shock absorbers away from high temperatures and open flames.



## **INSPECTION AND REPAIR**

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

- Torsion bar, height control arm
- Strut bar
- Stabilizer bar
- Shock absorber
- Rubber bushing

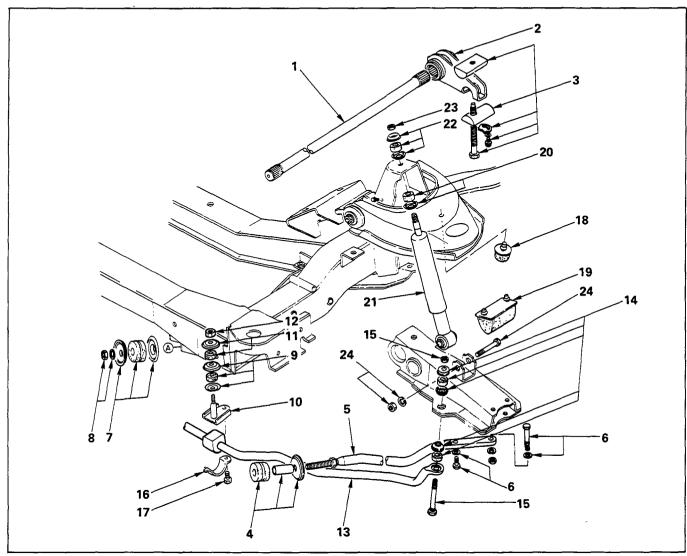


#### Visual Check

Inspect the following parts for wear, damage or other abnormal conditions.

# REASSEMBLY

#### 4 x 2 Model



## **Reassembly Steps**

#### **Torsion Bar**

- ▲ 1. Torsion bar
- 2. Height control arm
- ▲ 3. Adjustment bolt, seat, lock plate and bolt

#### **Strut Bar**

- 4. Rubber bushing, washer and tube
- ▲ 5. Strut bar
- ▲ 6. Bolt and washer
  - 7. Rubber bushing and washer
- ▲ 8. Nut and washer

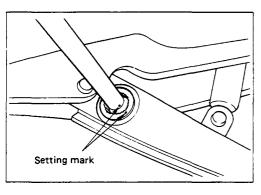
#### Stabilizer Bar

- 9. Rubber bushing and washer
- 10. Bracket
- 11. Rubber bushing and washer
- 12. Nut
- 13. Stabilizer bar
- 14. Rubber bushing and washer
- ▲ 15. Bolt and nut
  - 16. Bracket
  - 17. Bolt

#### **Shock Absorber**

- 18. Upper link bumper
- 19. Lower link bumper
- 20. Rubber bushing and washer
- 21. Shock absorber
- 22. Rubber bushing and washer
- ▲ 23. Nut
- ▲ 24. Bolt, nut and washer

#### 3C-14 FRONT SUSPENSION



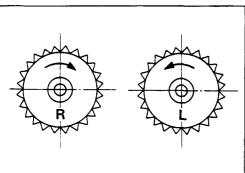


## **Important Operations**



#### 1. Torsion Bar

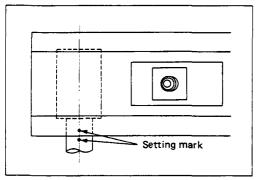
- Apply grease to the serrated portions.
- Align the scribe marks. (2)





Note the embossed mark on the end of the torsionbar.

R: Right side L: Left side





#### 2. Height Control Arm

(1) Apply grease to the portion that fits into the bracket.

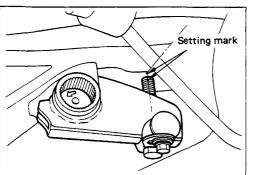
(2) Align the scribe marks.

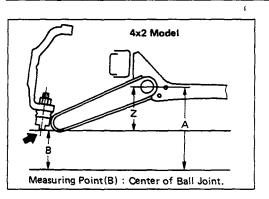




## 3. Adjust Bolt, Seat, Lock Plate and Bolt

(1) Turn in the adjustment bolt to location marked upon disassembly.



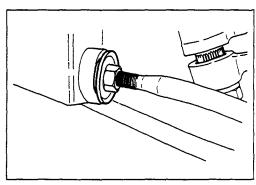




# (2) Check the vehicle trim height Trim Height (Z) = A - B

	mm(in)	Wheel size
4 x 2	56 (2.20)	14" Wheels
4 x 2	68 (2.68)	15" Wheels
4 x 4	130 (5,12)	15/16" Wheels

Difference in trim height L/hand to R/hand side should be 3mm ( $\leq$ ).





#### 5. Strut Bar

Adjust the caster angle by varying length of the strut bar (adjust with lock nut).

Caster		
Short Wheel Base	1°35' ± 45'	
Long (Except Flat Deck)	1°50' ± 45'	
Long (Flat Deck)	1°10' ± 45'	

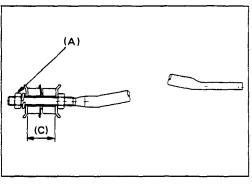
#### Note:

No more than 35' side to side variation.



## 6. Bolt, Nut and Washer

Strut Bar Bolt Torque	kg•m (lb.ft/N•m)
$7.0 \pm 0.7 (50.6 \pm 5.1/68)$	.7 ± 6.9)

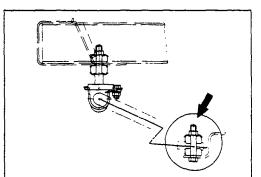




#### 8. Nut and Washer

Strut Bar Nut Torque

Model	Torque kg.m (lb.ft/N.m)	Distance (C) mm(in)
4 x 2	13.0 ± 1.3	56.0
7 7 2	$(94.0 \pm 9.4/127.5 \pm 12.8)$	(63.3)





#### 15. Bolt and Nut

Stabilizer Bar Bolt Torque	kg•m (lb.ft/N•m)
2.5 ± 0.5 (18.1 ±	3.6/24.5 ± 4.9)

## 3C-16 FRONT SUSPENSION



## 23. Nut

Shock Absorber Nut Torque kg⋅m(lb.ft/N⋅m)
2.0 ±0.5 (14.5 ±3.6/19.6 ±4.9)



## 24. Bolt, Nut and Washer

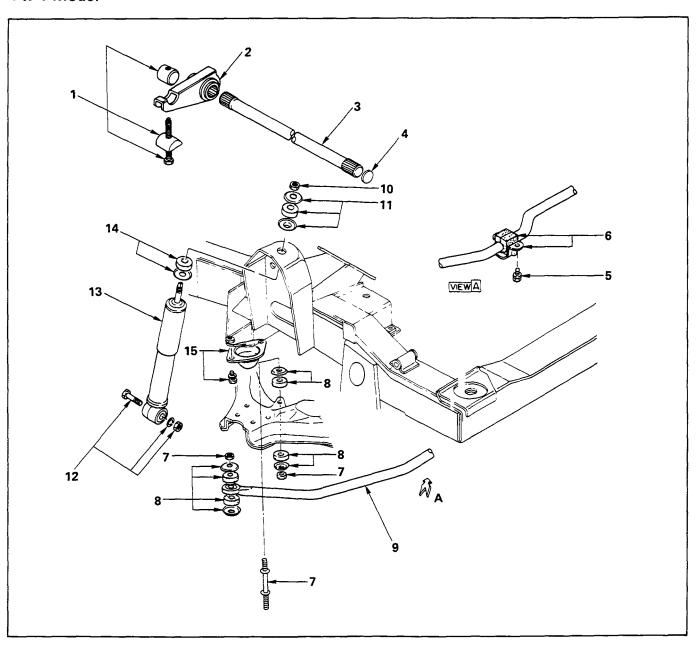
Shock Absorber Bolt Torque kg·m(lb.ft/N·m)

8.4 ±0.8 (60.8 ±5.8/82.4 ±7.8)

## TORSION BAR, STABILIZER BAR AND SHOCK ABSORBER

# DISASSEMBLY

#### 4 x 4 Model



## **Disassembly Steps**

#### **Torsion Bar**

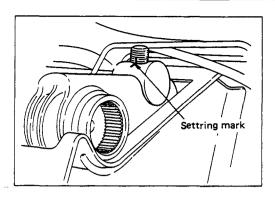
- 1. Adjust bolt and seat
- ▲ 2. Height control arm
- 3. Torsion bar
  - 4. Rubber seat

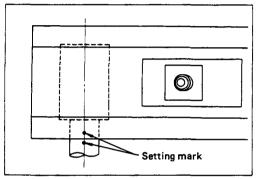
#### Stabilizer Bar

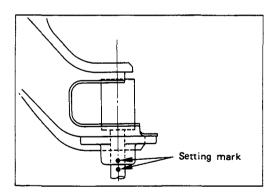
- 5. Bolt
- 6. Bracket and rubber bushing
- 7. Bolt, nut, and washer
- 8. Rubber bushing and washer
- 9. Stabilizer bar

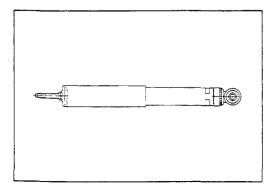
#### **Shock Absorber**

- 10. Nut
- 11. Rubber bushing and washer
- 12. Bolt, nut, and washer
- 13. Shock absorber
- 14. Rubber bushing and washer
- 15. Lower link bumper











## **Important Operations**

#### 1. Adjust Bolt

Apply the setting marks to the adjust bolt and height control arm.

#### 2. Height Control Arm

Apply the setting marks to the height control arm and torsion bar.

#### 3. Torsion Bar

Apply the setting marks to the torsion bar and lower link.

#### 13. Shock Absorber (For Australia)

#### **CAUTION:**

The shock absorbers have been charged with gas at the factory. Exposure to high temperatures or an open flame can result in a dangerous explosion.

Keep the shock absorbers away from high temperatures and open flames.



## **INSPECTION AND REPAIR**

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

- Torsion bar, height control arm
- Strut bar
- Stabilizer bar
- Shock absorber
- Rubber bushing

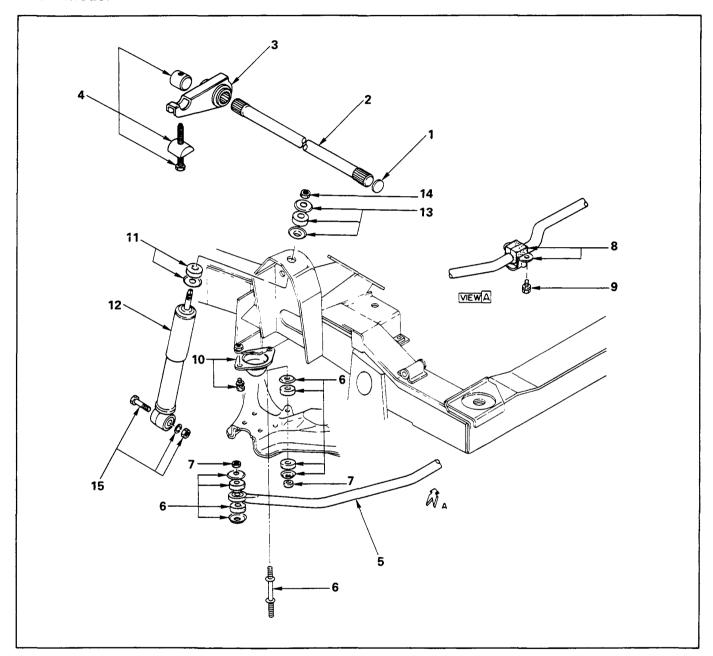


#### Visual Check

Inspect the following parts for wear, damage or other abnormal conditions.

# REASSEMBLY

#### 4 x 4 Model



## Reassembly Steps

#### **Torsion Bar**

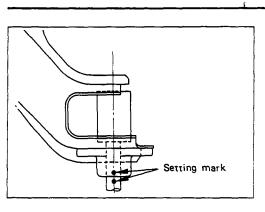
- 1. Rubber Seat
- 2. Torsion Bar
- ▲ 3. Height Control Arm
- ▲ 4. Adjust Bolt and Seat

#### Stabilizer Bar

- 5. Stabilizer bar
- 6. Rubber bushing, bolt and washer
- ▲ 7. Nut
  - 8. Bracket
  - 9. Bolt

#### **Shock Absorber**

- 10. Lower link bumper
- 11. Rubber bushing and washer
- 12. Shock absorber
- 13. Rubber bushing and washer
- ▲ 14. Nut
- ▲ 15. Bolt, nut, and washer





## **Important Operations**



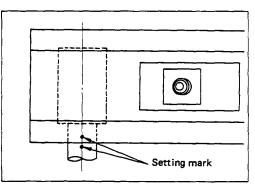
- 2. Torsion Bar
- (1) Apply grease to the serrated portions.



Align the setting marks.



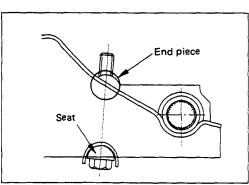
- (3) Note the emboss mark on its side face.
  - R: Right side
  - L: Left side

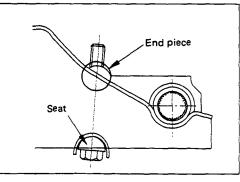




#### 3. Height Control Arm

- (1) Apply grease to the portion that fits into the bracket.
- (2) Align the setting marks.
- Apply grease to the bolt portion of the end piece. (3)
- Apply grease to the portion of the seat that fits in to (4) the bracket.

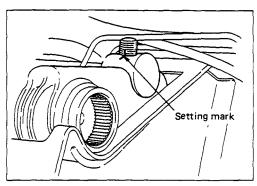




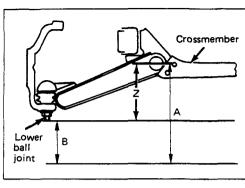


## 4. Adjust Bolt

(1) Turn in the adjust bolt to location marked during disassembly.



## 3C-22 FRONT SUSPENSION





(2)

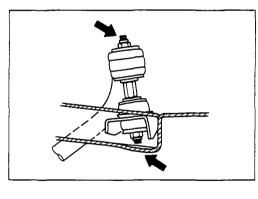
Trim Height	
	130 (5.1

Stabilizer Bar Bolt Torque

Check the vehicle trim height. Trim height (Z) = A - B

mm(in)

 $kg \cdot m(lb.ft/N \cdot m)$ 





## 14. Nut

7. Bolt

14. Nut	
Shock Absorber Nut Torque	kg·m(lb.ft/N·m)
20+05 (145+36/1	96+49)

1.0 (7.2/9.8)

2)

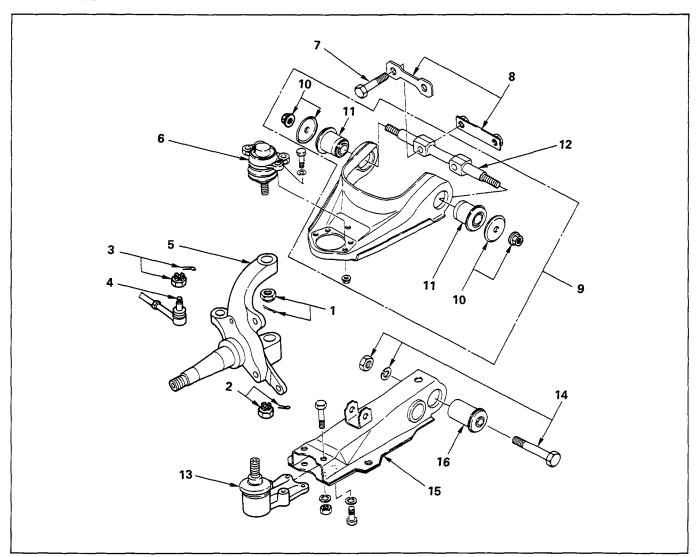
# 15. Bolt

Shock Absorber Bolt  $8.4 \pm 0.8$  (60.8  $\pm 5.8/82.4 \pm 7.8$ )

## KNUCKLE, UPPER LINK AND LOWER LINK



#### 4 x 2 Model



## **Disassembly Steps**

#### Knuckle

- 1. Nut and cotter pin
- 2. Nut and cotter pin
- 3. Nut and cotter pin
- 4. Steering link end
- 5. Knuckle

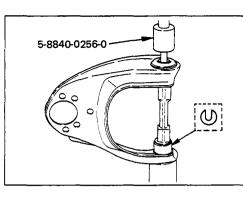
## **Upper Link**

- 6. Upper end
- 7. Boft and washer
- 8. Nut Assembly
- 9. Upper link assembly
- 10. Nut and plate
- ▲ 11. Bushing
  - 12. Fulcrum pin

#### **Lower Link**

- 13. Lower end
- 14. Bolt, nut and washer
- ▲ 15. Lower link assembly
- ▲ 16. Bushing

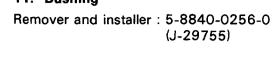
## 3C-24 FRONT SUSPENSION

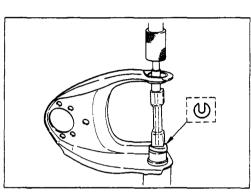




## **Important Operations**

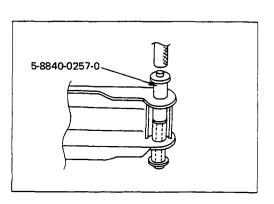
## 11. Bushing





## 15. Lower Link Assembly

Before removal, remove the torsion bar, strut bar, stabilizer bar and shock absorber.





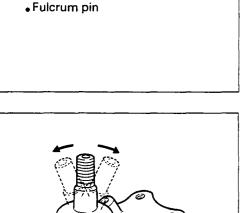
## 16. Bushing

Remover and installer: 5-8840-0257-0 (J-29756)



## INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.



Knuckle, Knuckle arm

 Upper link, lower link, bushing • Upper end, lower end, boot



## Visual Check

Inspect the following parts for wear, damage or other abnormal conditions.



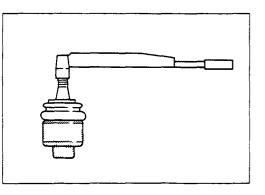
## Upper Link End and Lower Link End

its normal movement.

Inspect the upper and lower link end boot for damage or grease leak. Move the Ball Joint as shown in the Figure, then confirm

Inspect screw/taper area of Ball Joint for defects.

If any defects are found by the above inspections, replace the end assembly with new one.





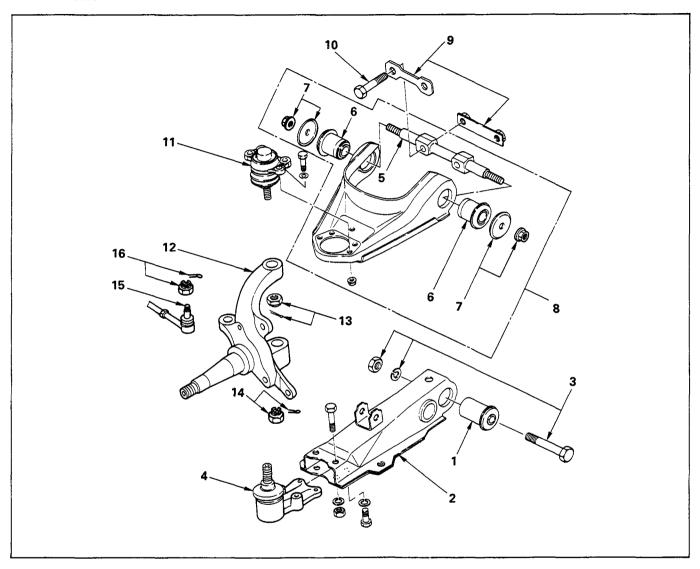
After moving the Ball Joint 4 or 5 times, attach nuts then measure the preload.

Preload	kg·m(lb.ft/N·m)
Upper link end	0.1-0.33 (0.7-2.4/0.9-3.2)
Lower link end	0.05-0.35 (0.35-2.5/0.5-3.4)
Lower link end	0.05-0.35 (0.35-2.5/0.5-3

If the above limits specified are exceeded, replace the end assembly.

# REASSEMBLY

#### 4 x 2 Model



## **Reassembly Steps**

#### **Lower Link**

- ▲ 1. Bushing
  - 2. Lower link assembly
- ▲ 3. Bolt, nut and washer
- 4. Lower end

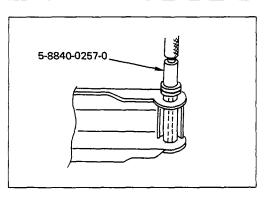
## **Upper Link**

- ▲ 5. Fulcrum pin
- 6. Bushing
- ▲ 7. Plate and nut
  - 8. Upper link assembly
  - 9. Nut assembly
- ▲ 10. Bolt and washer

▲ 11. Upper end

#### Knuckle

- 12. Knuckle
- ▲ 13. Nut and cotter pin
- ▲ 14. Nut and cotter pin
  - 15. Steering link end
- ▲ 16. Nut and cotter pin





## **Important Operations**



#### 1. Bushing

Remover and Installer: 5-8840-0257-0

(J-29756)

### 3. Bolt, Nut and Washer

Tighten lower link nut finger-tight.

Perform the secure tightening after adjusting buffer clearance.

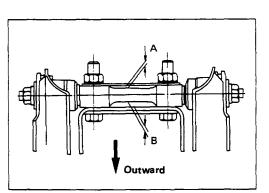


#### 4. Lower End

Lower End Bolt Torque

kg·m(lb.ft/N·m)

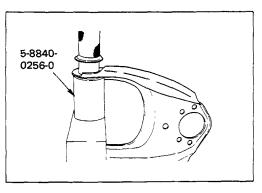
 $7.0 \pm 0.7 (50.6 \pm 5.1/68.7 \pm 6.9)$ 





#### 5. Fulcrum Pin

Install the smaller clearance A to be inside and larger clearance B outside of vehicle.

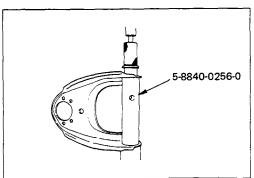




#### 6. Bushing

Remover and Installer: 5-8840-0256-0

(J-29755)



#### 7. Pleate and Nut

Tighten fulcrum pin nut finger-tight.

Perform the secure tightening after adjusting buffer clearance.



#### 10. Bolt

Fulcrum Pin Bolt Torque  $kg \cdot m(lb.ft/N \cdot m)$  $15.5 \pm 1.5 (112.1 \pm 10.8/152.0 \pm 14.7)$ 



#### 11. Upper End

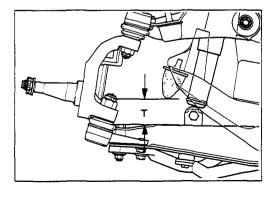
Upper End Torque kg·m(lb.ft/N·m)  $33\pm0.3(23.9\pm2.2/32.4\pm2.9)$ 



#### 13, 14, 16, Nut

kg·m(lb.ft/N·m) Knuckle Nut Torque  $15.0 \pm 1.0$ Lower End  $(108.5 \pm 7.2/147.1 \pm 9.8)$  $10.0 \pm 1.0 (79.7 \pm 7.2/107.9 \pm 9.8)$ Upper End  $10.0 \pm 1.0 (79.7 \pm 7.2/107.9 \pm 9.8)$ Steering Link End

Fasten the bushing nut, and keep the buffer clearance as





shown on the left diagram.

T = 53 mm (2.09 in)



#### **Lower Link Nut**

Lower Link Nut Torque  $kg \cdot m(lb.ft/N \cdot m)$  $12.9 \pm 1.3 (93.3 \pm 9.4/126.5 \pm 12.8)$ 



#### **Upper Link Nut**

Upper Link Nut Torque  $kg \cdot m(lb.ft/N \cdot m)$ 

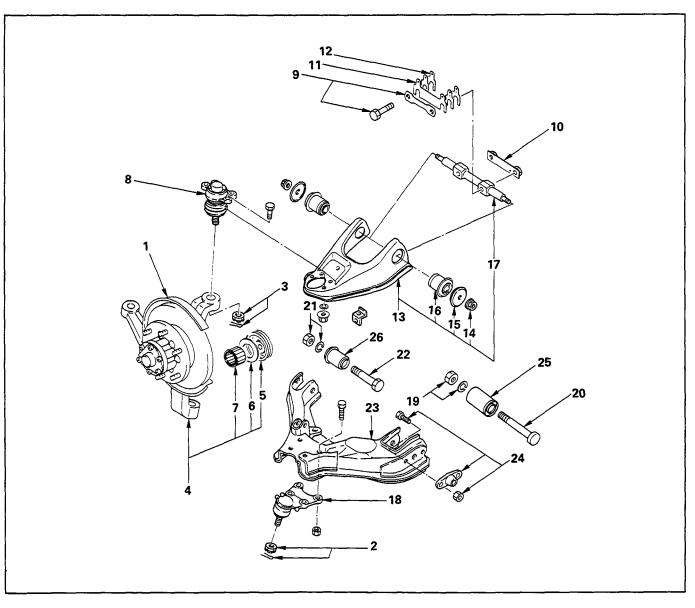
 $11.0 \pm 1.5 (79.6 \pm 10.8/107.9 \pm 14.7)$ 

## KNUCKLE, UPPER LINK AND LOWER LINK



## **DISASSEMBLY**

#### 4 x 4 model



#### **Disassembly Steps**

#### Knuckle

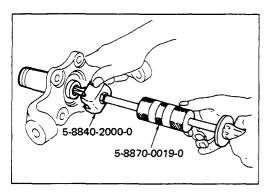
- 1. Back plate and hub
- 2. Nut and cotter pin
- 3. Nut and cotter pin
- 4. Knuckle
- 5. Oil Seal
- 6. Washer
- 7. Needle bearing

#### **Upper Link**

- 8. Upper end
- 9. Bolt and plate
- 10. Nut assembly
- ▲ 11. Camber shims
- ▲ 12. Caster shims
  - 13. Upper link assembly
  - 14. Nut
  - 15. Plate
- ▲ 16. Bushing
  - 17. Fulcrum pin

#### **Lower Link**

- 18. Lower end
- 19. Nut and washer
- 20. Bolt
- 21. Nut and washer
- 22. Bolt
- ▲ 23. Lower link assembly
  - 24. Torsion bar arm
- ▲ 25. Bushing
- ▲ 26. Bushing





## Important operations

### 7. Needle Bearing

Remover: 5-8840-2000-0

(J-5822)

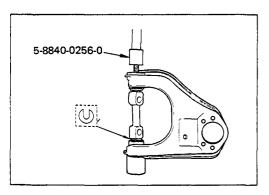
Sliding hammer: 5-8840-0019-0

(J-23907)

#### 11. Camber Shims

#### 12. Caster Shims

Note the positions and number of shims.

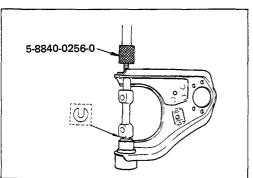




## 16. Bushing

Remover and installer: 5-8840-0256-0

(J-29755)

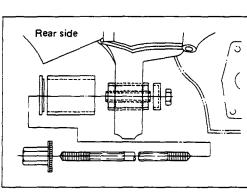




Before removal, remove the torsion bar, stabilizer bar and shock absorber.



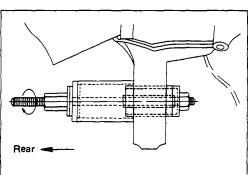
Brake hoses should be removed before disassembly and installed after reassembly to avoid serious damage.





25. Bushing : Rear Side

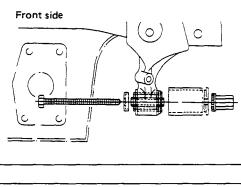
Remover and Installer : 5-8840-2124-0 (J-36834)

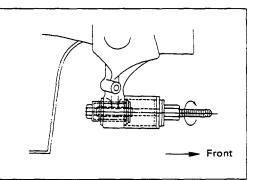




26. Bushing : Front Side

Remover and Installer : 5-8840-2123-0 (J-36833)





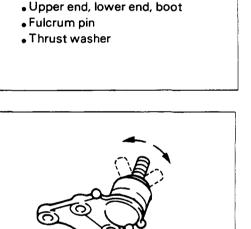
Knuckle, Knuckle arm

Needle bearing, oil sealUpper link, lower link, bushing



## INSPECTION AND REPAIR

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.





## Visual Check

Inspect the following parts for wear, damage, or other abnormal conditions.



## Upper Link End and Lower Link End

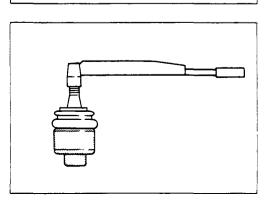
grease leak.

Move the ball joint as shown in the figure, then confirm its normal movement.

Inspect the upper and lower link end boot for damage or

Inspect screw/taper area of ball joint for defects.

If any defects are found by the above inspections, replace the end assembly with new one.





After moving the Ball Joint 4 or 5 times, attach nuts then measure the preload.

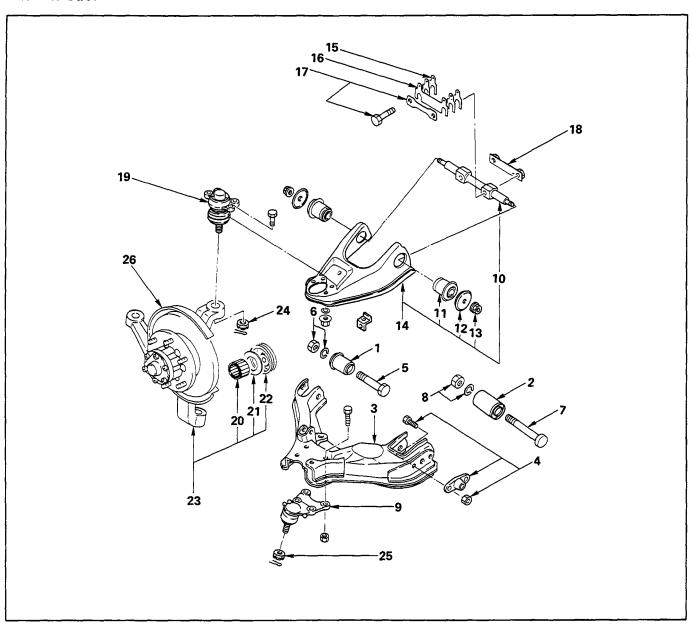
Preload	kg·m(lb.ft/N·m)
Upper link end	0.1-0.33 (0.7-2.4/0.9-3.2)
Lower link end	0.07-0.65 (0.15-1.43/0.06-0.64)

If the above limits specified are exceeded, replace the end assembly.



## **REASSEMBLY**

#### 4 x 4 Model



#### Reassembly Steps

#### **Lower Link**

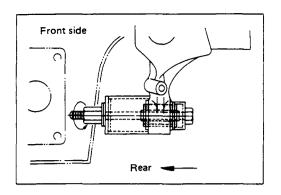
- ▲ 1. Bushing; front
- ▲ 2. Bushing; Rear
  - 3. Lower link assembly
- ▲ 4. Torsion bar arm 5. Bolt
- ▲ 6. Nut and washer
  - 7. Bolt
- 8. Nut and washer
- 9. Lower End

#### **Upper Link**

- 10. Fulcrum pin
- ▲ 11. Bushing
- 12. Plate
- ▲ 13. Nut
- ▲ 14. Upper link assembly
- ▲ 15. Caster shims
- ▲ 16. Caster shims
- ▲ 17. Bolt and plate 18. Nut assembly
- ▲ 19. Upper end

#### Knuckle

- ▲ 20. Needle bearing
  - 21. Washer
- ▲ 22. Oil seal
  - 23. Knuckle
- ▲ 24. Nut and cotter pin
- ▲ 25. Nut and cotter pin
  - 26. Back plate



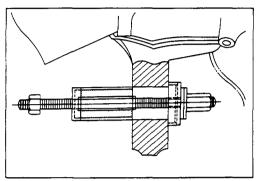


## **Important Operations**



Remover and Installer: 5-8840-2123-0

(J-36833)

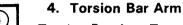




#### 2. Bushing; Rear Side

Remove and Installer: 5-8840-2124-0

(J-36834)



Torsion Bar Arm Torque

kg·m(lb.ft/N·m)

 $11.8 \pm 1.0 (85.3 \pm 7.2/115.7 \pm 9.8)$ 

#### 6. 8. Nut and Washer

Tighten Lower Link Nut finger-tight.

Perform the secure Tightening after adjusting Buffer Clearance.

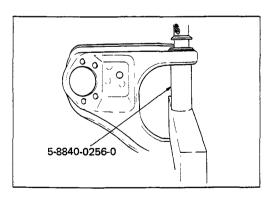


#### 9. Lower End

Lower End Bolt Torque

kg·m(lb.ft/N·m)

 $10.5 \pm 1.0 (75.9 \pm 7.2/103.0 \pm 9.8)$ 

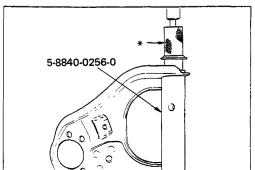




#### 11. Bushing

Remover and Installer: 5-8840-0256-0

(J-29755)

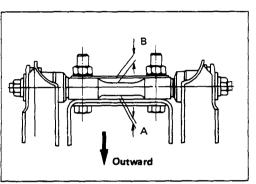


Apply a suitable socket to (\*) portion.

#### 13. Nut

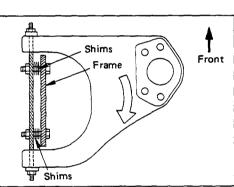
Tighten fulcrum pin nut finger-tight.

Perform the secure tightening after adjusting buffer clearance.



## 14. Upper Link Assembly

Install the smaller clearance A outside and larger clearance B inside of vehicle.



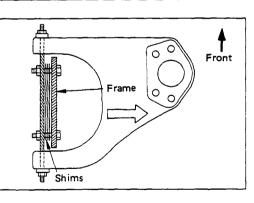
## 7 15. Caster Shims

Caster angle

Short Wheel Base	Long Wheel Base
1°55′ ± 45′	2°10′ ± 45′

#### Note:

No more than 35' side to side variation.



## 16. Camber Shims

Camber angle

30' ± 60'

#### Note:

No more than 45' side to side variation.



#### 17. Bolt and Plate

Fulcrum Pin Bolt Torque kg·m(lb.ft/N·m)

 $15.5 \pm 1.5 (112.1 \pm 10.8/152.0 \pm 14.7)$ 



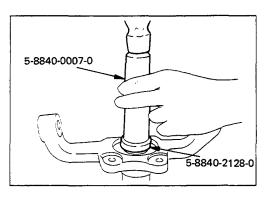
Apply oil to the thread.



#### 19. Upper End

Upper End Bolt Torque kg·m(lb.ft/N·m)

 $3.3 \pm 0.3 (23.9 \pm 2.2/32.4 \pm 2.9)$ 





### 20. Needle Bearing

Installer: 5-8840-2128-0

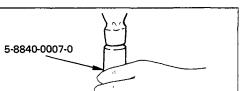
(J-36838)

Grip: 5-8840-0007-0

(J-8092)



Before installation, apply the appropriate amount of specified grease (Besco L2 or equivalent) to the bearing (Approx. 15g).



5-8840-2127-0



#### 22. Oil Seal

Installer: 5-8840-2127-0

(J-36837)

Grip: 5-8840-0007-0

(J-8092)

- Insert the thrust washer into the knuckle.
- After fitting the oil seal to the setting tool; installer, drive it to the knuckle using a hammer or bench press until the tool front face contacts with the thrust washer.
- Apply the specified grease to the thrust washer, and install after turning the place where there is a chamfer to the spindle.

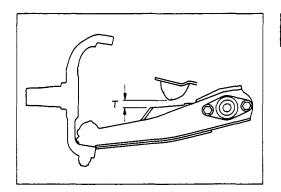


 Use a new oil seal, and apply the specified grease (Besco L2 or equivalent) to the place surrounded by the lip (Approx. 15g).



#### 24. 25. Nut and Cotter Pin

Torque	kg·m(lb.ft/N·m)
Upper Link End	$10.0 \pm 1.0 (72.3 \pm 7.2/98.1 \pm 9.8)$
Lower Link End	$13.0 \pm 1.0 (94.0 \pm 7.2/127.5 \pm 9.8)$
Track Rod End	$11.0\pm1.0$ (79.6 $\pm7.2/107.9\pm9.8$ )





Fasten the bushing nut and keep the buffer clearance as shown on the left diagram.

T = 15 mm (0.59 in)

## **Nut and Washer**

Front Lower Link Nut Torque  $kg \cdot m(lb.ft/N \cdot m)$  $16.0 \pm 2.0 (115.7 \pm 14.5/156.9 \pm 19.6)$ 

Apply oil to the thread.

Nut and Washer

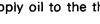
Rear Lower Link Nut Torque

 $20.0 \pm 2.0 (144.7 \pm 14.5/196.1 \pm 19.6)$ 

Apply oil to the thread.

Fulcrum Pin Nut Torque

Nut





 $11.0 \pm 1.5 (112.1 \pm 10.8/152.0 \pm 14.7)$ 









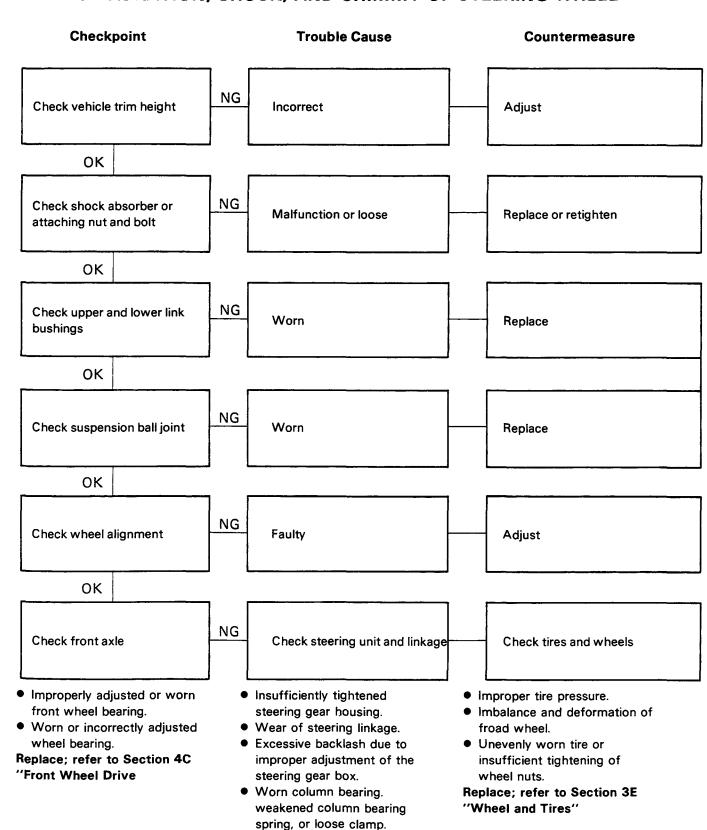
 $kg \cdot m(lb.ft/N \cdot m)$ 

FRONT SUSPENSION 3C-37

- $kg \cdot m(lb.ft/N \cdot m)$

## TROUBLESHOOTING

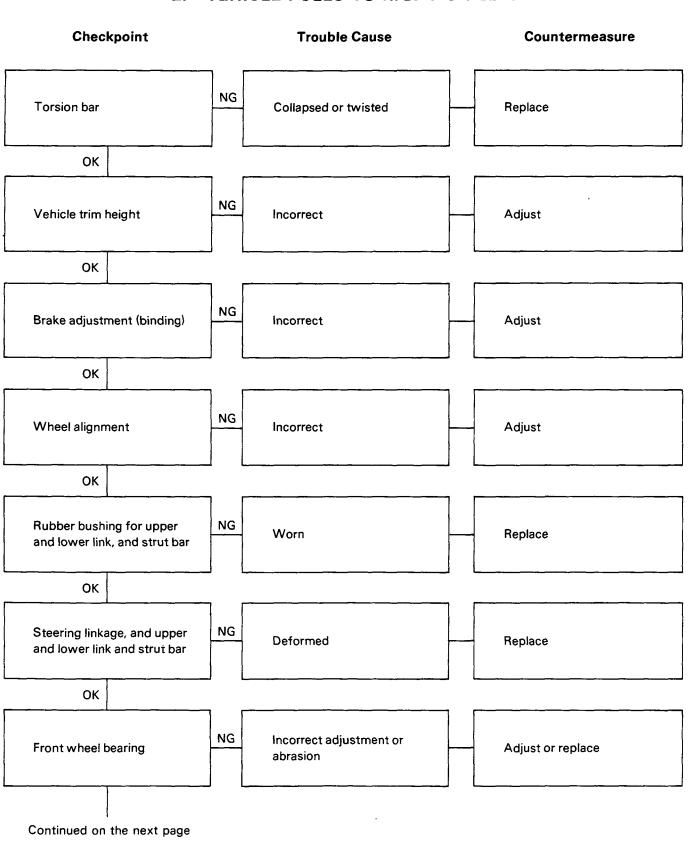
## VIBRATION, SHOCK, AND SHIMMY OF STEERING WHEEL



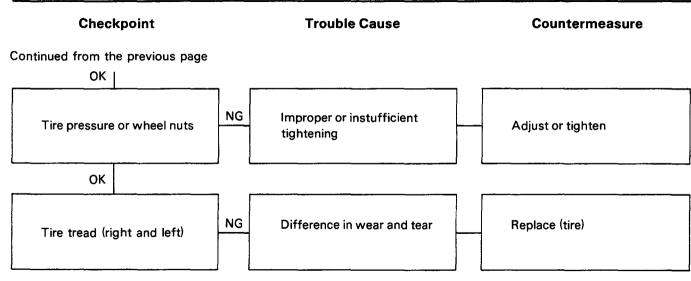
Replace; refer to Section 3B

"Steering"

## 2. VEHICLE PULLS TO RIGHT OR LEFT



## 3C-40 FRONT SUSPENSION



Countermeasure

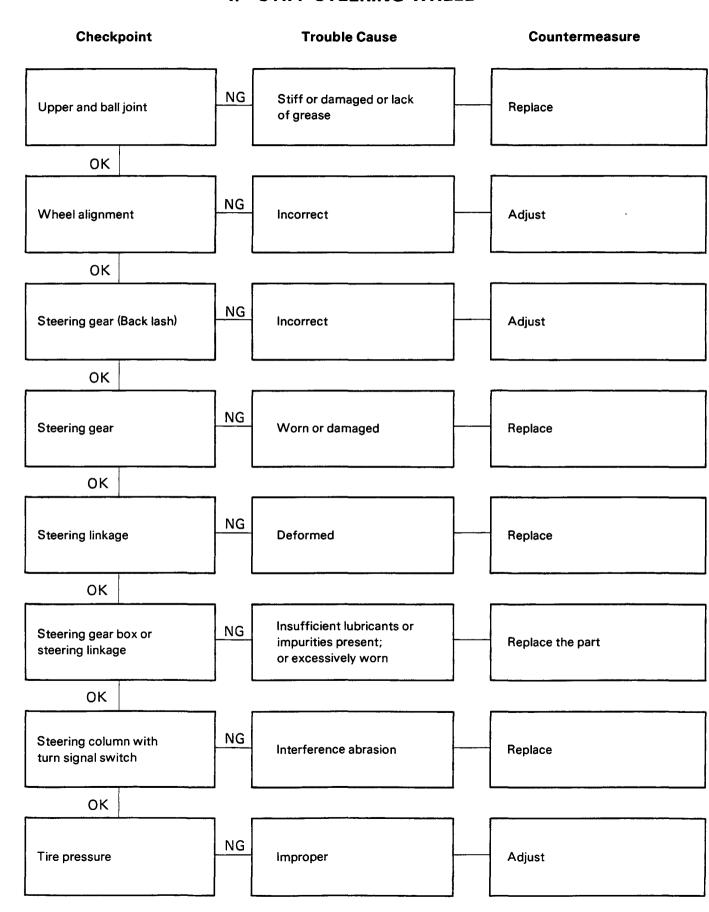
## 3. INSTABILITY OF VEHICLE

**Trouble Cause** 

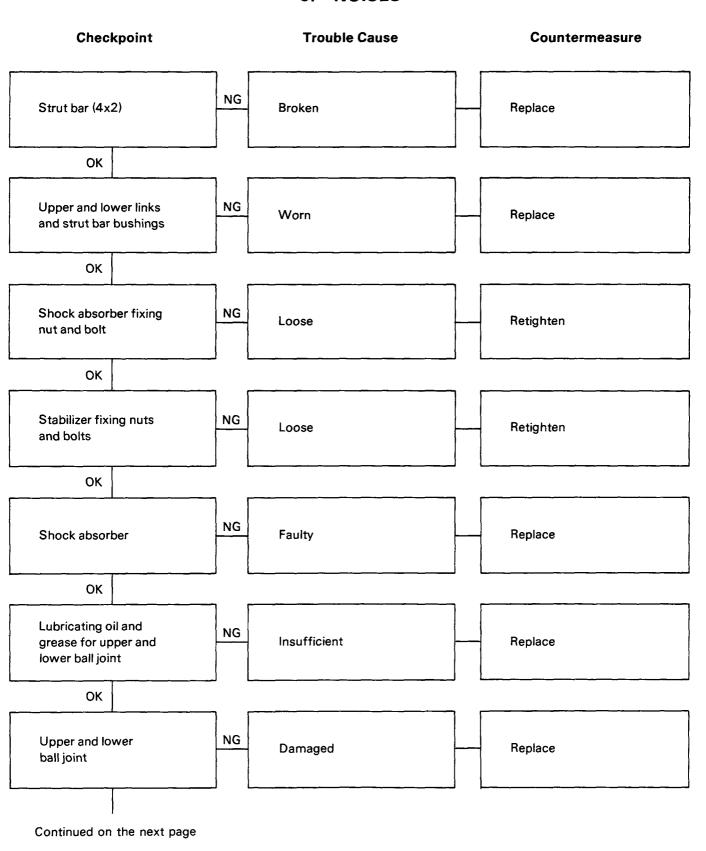
Checkpoint

onookpoint.		1100010 00000	
Vehicle trim height	Vehicle trim height NG Incorrect		Adjust
ОК			
Rubber bushings for upper and lower links. and strut bar (4x2)	NG	Worn	Replace
ок			
Steering linkage and upper and lower links	NG	Worn or deformed	Replace
ок			
Wheel alignment	NG	Incorrect	Adjust
ок			
Steering gear (back lash and worm bearing preload)	NG	Incorrect	Adjust
ОК			
Tire pressure	NG	Improper	Adjust
ОК			
Road wheel	NG	Deformed or unbalanced	Adjust

## 4. STIFF STEERING WHEEL

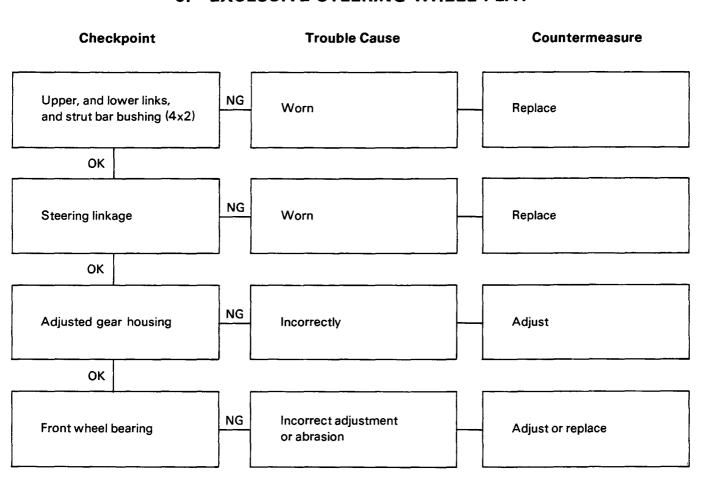


## 5. NOISES

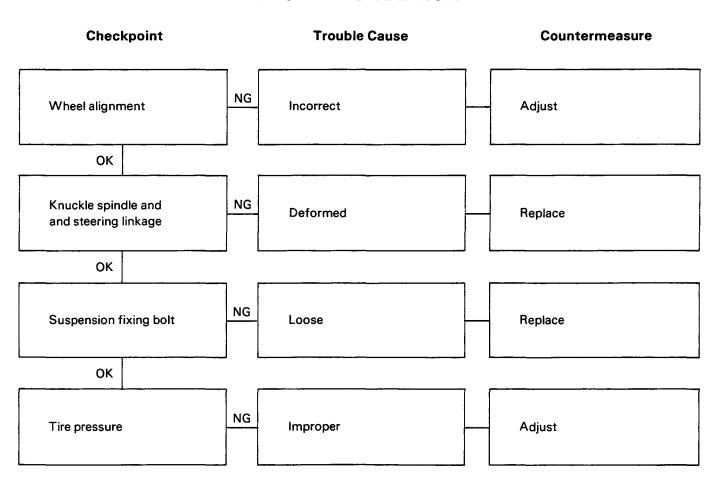


Checkpoint	Trouble Cause	Countermeasure
Continued from the previous page OK		
Tire pressure	NG Improper	Adjust
ОК		
Steering linkage and steering gear	NG Worn	Replace
ОК		
Front wheel bearing	NG Incorrect adjustment or abrasion	Adjust or replace
ОК		
Steering unit fixing bolts and linkage	NG Loose	Retighten
ОК		
Lubricating oil and grease to steering linkage	NG Insufficient	Replace

#### 6. EXCESSIVE STEERING WHEEL PLAY



## 7. GRATING TIRE NOISE



## 8. EXCESSIVELY OR PARTIALLY WORN TIRE

Chec	kpoint		Trouble Cause		Countermeasure
Tire pressure	•	NG	Improper		Adjust
ОК					
Wheel alignn	nent	NG	Incorrect		Adjust
ОК					
Front wheel t	oearing	NG	Faulty		Replace
ОК					
Brake adjusti	ment	NG	Incorrect		Adjust
ОК		_			
Tire rotation		NG	Not rotated		Rotate tires at recomended intervals
		_		_	

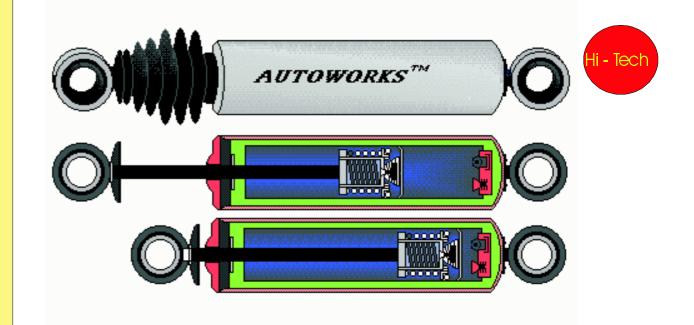


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Specs.

Description

Repair





# SECTION 3D REAR SUSPENSION

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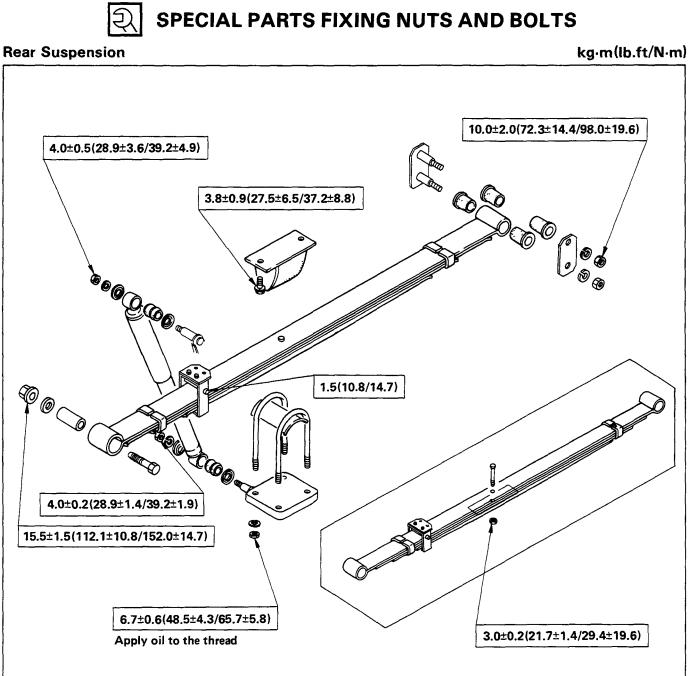
	PAGE
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Rear Suspension	3D- 4
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Troubleshooting	3D-12

## MAIN DATA AND SPECIFICATIONS

Items	Models	4 x 2		4 x 2 (15" Wheels)		4 x 4	
Туре		Semi-eliptic, rubber t			s and dire	ect	
		double acting shock	absorb	ers.			
Main spring							
No. of leaves			4			5	
Leaf thickness - Numbe	ered mm(in)	7 (0.276)	; No. 1	-2	6.5 (	0.256) ; No. 1	
(Top to bottom)	, ,	6 (0.236				236) ; No. 2-4	
·		15 (0.59	•			).591) ; No. 5	
Spring eye type			В	erlin eye type			
Bushing outside dia.	mm(in)		Fro	nt; 40 (1.575)			
Lenght	mm(in)	1200 (47.244)					
Width	mm(in)	60 (2.362)					
Rate - Unclamped	kg/mm	2.61	/7.96		2.	2.85/7.90	
	(lb/in)	(146.0/445.4)		(15	9.4/441.9)		
Clamped	kg/mm						
	(lb/in)						
Rear spring capacity	kg	70	88			763	
	(lb/N)	(1693	/7532)		(168	(1682/7483)	
Weight	kg(lb/N)	15.6 (34.4/153)		18.4	(40.6/180)		
Shock absorbers							
Type: Hydraulic, double	e acting, teles	copic Base and LE 4 x 2 models					
Gas pressurised	, double acting	g telescopic LX	and 4	x 4 models			
Mean stroke	mm(in)	, , ,		REAR	140 (5,51)		
Compressed lenght	mm(in)			210 (8.27)		235 (9,25)	
Extended lenght	mm(in)			325 (12.80)		375 (14.76)	
Damping rate	kg(N)						
Compression			-	145) at 0,3 m/se			
Rebond	:	134,5 (1345) at 0,3 m/sec					
Bump rubber							
Height	mm(in)	(in) 69 (2.72) 84 (3.3		84 (3.31)			
				5			

## TORQUE SPECIFICATIONS

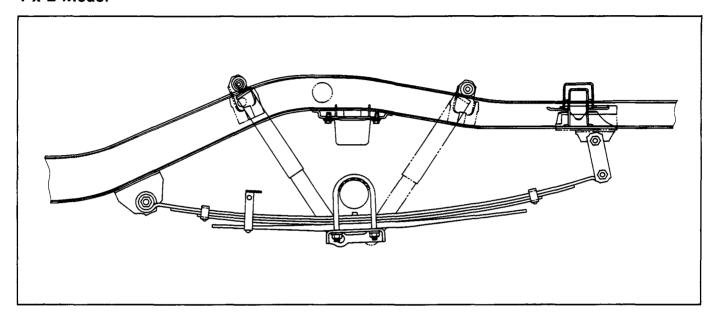




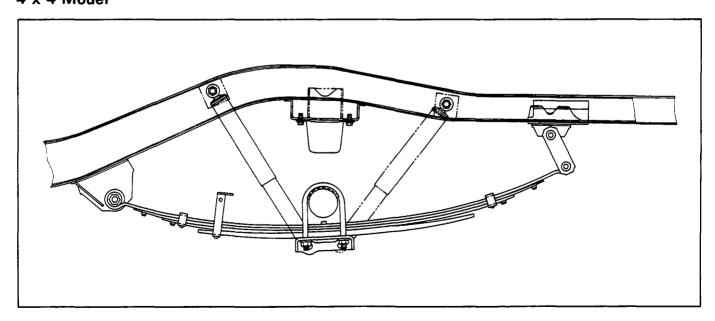
## **REAR SUSPENSION**

## **GENERAL DESCRIPTION**

#### 4 x 2 Model



#### 4 x 4 Model



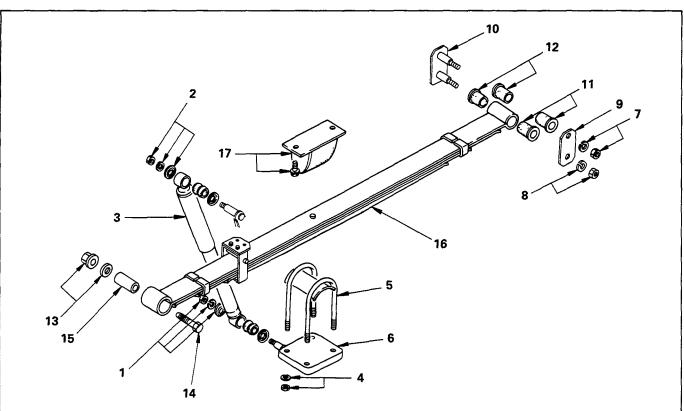
Rear suspension absorbs vibration from the road surface thus preventing vehicle damage, as well as providing a good ride.

#### Components parts

- Spring between the body and the axle case
- Spring shackle connecting the spring to the body
- Clamp and U-bolt fixing the axle case to the spring
- Shook absorbar as a sountarmassure for vibration



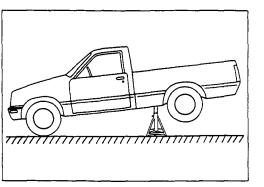
## **DISASSEMBLY**



## **Disassembly Steps**

- ▲ 1. Nut and washer
- 2. Nut and washer3. Shock absorber
- 4. Nut and washer
- 5. U-bolt
  - 6. Lower clamp
- 7. Nut and washer
- 8. Nut and washer
- 9. Shackle plate

- ▲ 10. Shackle
  - 11. Rubber bushing
  - 12. Rubber bushing
- ▲ 13. Nut and washer
- ▲ 14. Bolt, washer and spring pin
- ▲ 15. Bushing
  - 16. Leaf spring assembly
  - 17. Bolt and bump rubber

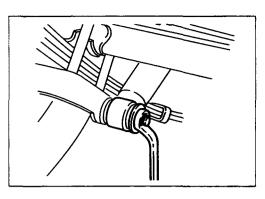


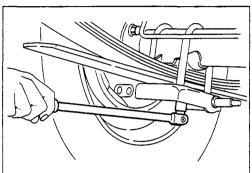


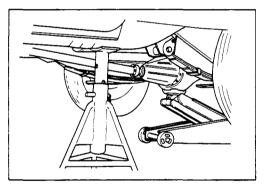
## **Important Operations**

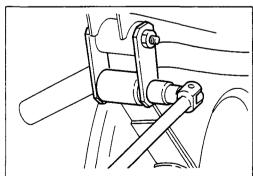
Jack up the rear axle and place chassis stands under the frame near the front end of the rear spring brackets.

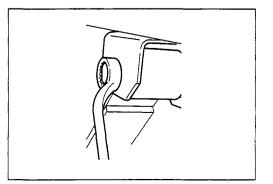
#### 3D-6 REAR SUSPENSION











#### 1. 2. Nut and Washer

#### Caution (Australia only):

The shock absorbers have been charged with gas at the factory. Exposure to high temperatures or an open flame can result in a dangerous explosion.

Keep the shock absorbers away from high temperatures and open flames.

#### 4. Nut and Washer

#### 5. U-bolt

Jack up the rear axle case slightly to separate it from the leaf spring assemblies.

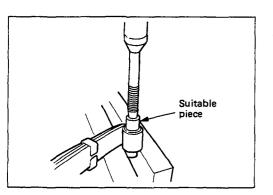
#### 7. 8. Nut and Washer

#### 9. 10. Shackle

Remove the nut and drive out the shackle with a hammer using a brass bar.

## 13. 14. Nut, Washer, Bolt and Spring Pin

Remove the nut and drive out the spring pin with a hammer using a brass drift.





#### 15. Bushing

Remove the bushing using a bench press.



## INSPECTION AND REPAIR

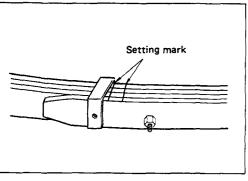
Make correction or parts replacement if wear, damage or their abnormal conditions are found through inspection.

- Leaf spring assembly
- Clip
- Center bolt
- U-bolt
- Spring pin
- Shackle pin
- Shock absorber
- Bump rubber
- Rubber bushing
- Bump rubber seat



#### Visual Check

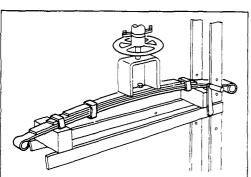
Inspect the following parts for wear, damage or their abnormal conditions.





#### **Leaf Spring Assembly Replacement**

- Apply a setting mark across the springs before disassembling the leaf spring assembly.
- Apply grease to both faces of each leaf spring at assembly.
- Use a bench press for disassembly and reassembly.
- Discard center bolt and install a new one.





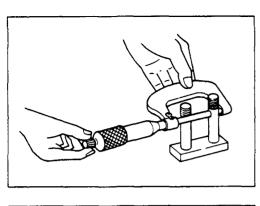
#### **Center Bolt**

Center Bolt Torque

kg·m(lb.ft/N·m)

 $3.0 \pm 0.2 (21.7 \pm 1.4/29.4 \pm 19.6)$ 

#### 3D-8 REAR SUSPENSION





17.93 - 18.00 (0.706 - 0.709)

mm(in.)

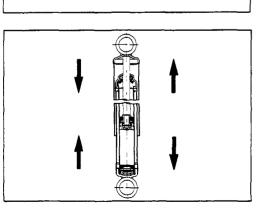
Shackle Pin Diameter

## **Spring Pin**

mm(in.)

Spring Pin Diameter

13.8 - 14.0 (0.543 - 0.551)



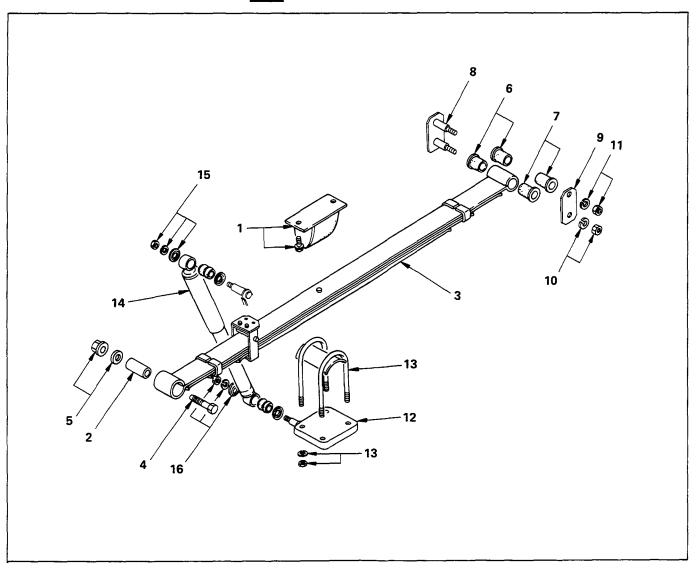


Shock Absorber

Inspection operation of shock absorber

If no resistance is felt while expanding the shock absorber, that indicates the absorber is faulty.

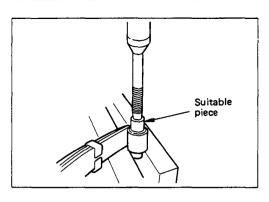
## **REASSEMBLY**



## **Reassembly Steps**

- 1. Bump rubber
- 2. Bushing
- 3. Leaf spring assembly
  - 4. Spring pin, bolt and washer
- 5. Nut and washer
- 6. Rubber bushing
- 7. Rubber bushing 8. Shackle

- 9. Shackle plate
- ▲ 10. Nut and washer
- ▲ 11. Nut and washer
- 12. Lower clamp
- ▲ 13. U-bolt and nut
- ▲ 14. Shock absorber ▲ 15. Nut and washer
- ▲ 16. Nut and washer



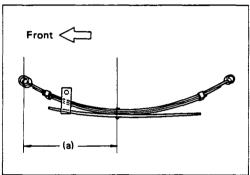


#### **Important Operations**



#### 2. Bushing

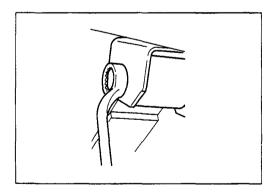
Install the bushing using a bench press.





#### 3. Leaf Spring Assembly

The leaf spring assembly should be installed so that the shorter length (a) (distance between center bolt and center of spring eye) is toward the front.



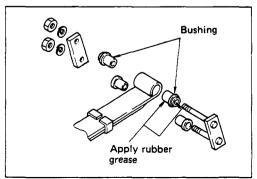


#### 5. Nut and Washer

Spring Pin Torque

kg·m(lb.ft/N·m)

 $15.5 \pm 1.5 (112.1 \pm 10.8/152.0 \pm 14.7)$ 





#### 6. 7. Rubber Bushing

Apply rubber grease to inside and outside of the rubber bushing.

#### 8. 9. Shackle



#### 10. 11. Nut and Washer

Install bushing with collar on the leaf spring, then install and tighten the nut.

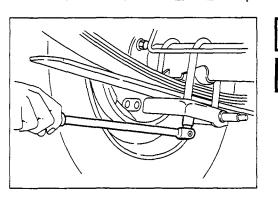
#### Note:

Tighten the nuts to the specified torque with the vehicle empty.

Shackle Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $10.0 \pm 2.0 (72.3 \pm 14.4/98.0 \pm 19.6)$ 





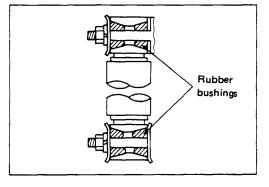
#### 13. U-bolt and Nut

When tightening the nuts apply oil as necessary to prevent damaging the threads.

**U-bolt Nut Torque** 

kg·m(lb.ft/N·m)

 $6.7 \pm 0.6 (48.5 \pm 4.3/65.7 \pm 5.8)$ 





#### 14. Shock Absorber

#### 15. 16. Nut and Washer

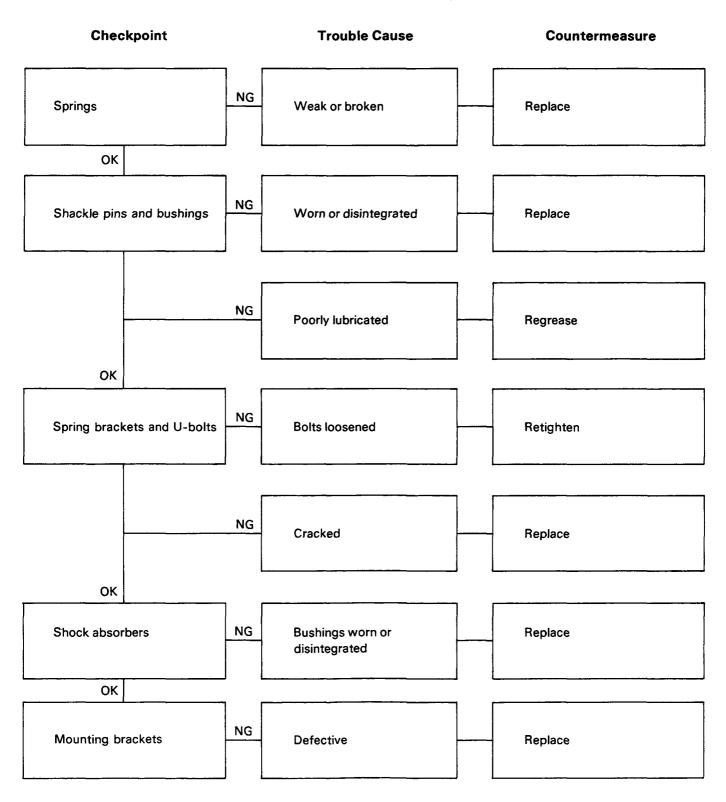
Refer to the drawing for parts installation.

Shock Absorber Nut Torque kg·m(lb.ft/N·m)

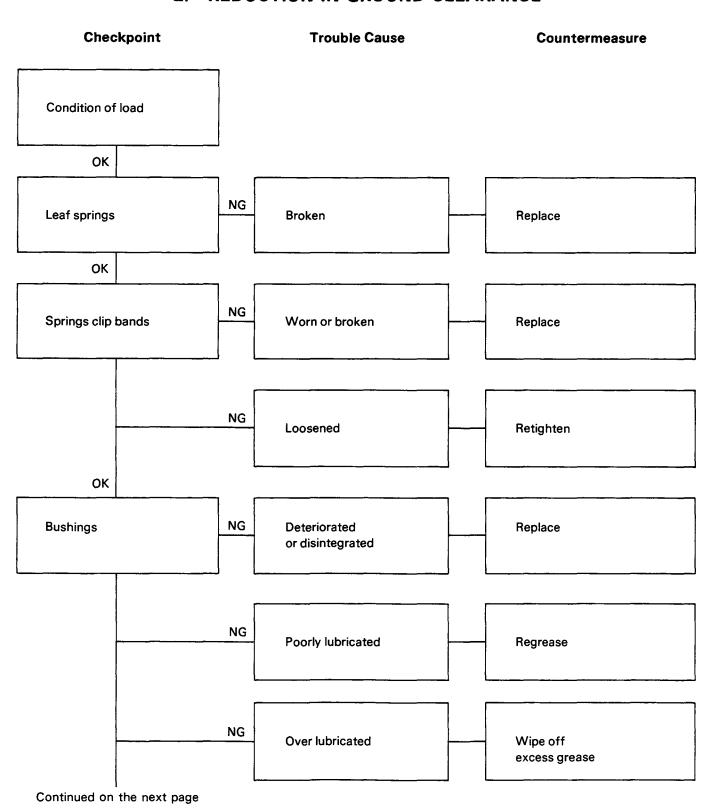
 $4.0 \pm 0.5 (28.9 \pm 3.6/39.2 \pm 4.9)$ 

## **TROUBLESHOOTING**

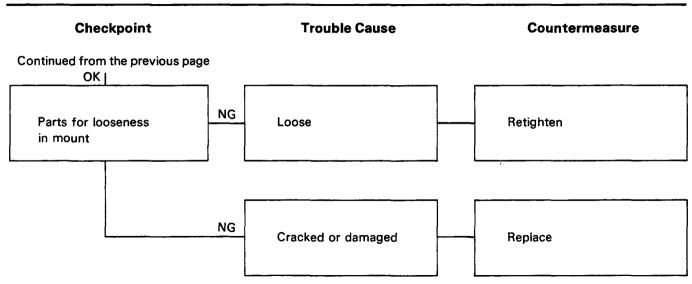
#### 1. BODY INCLINATION



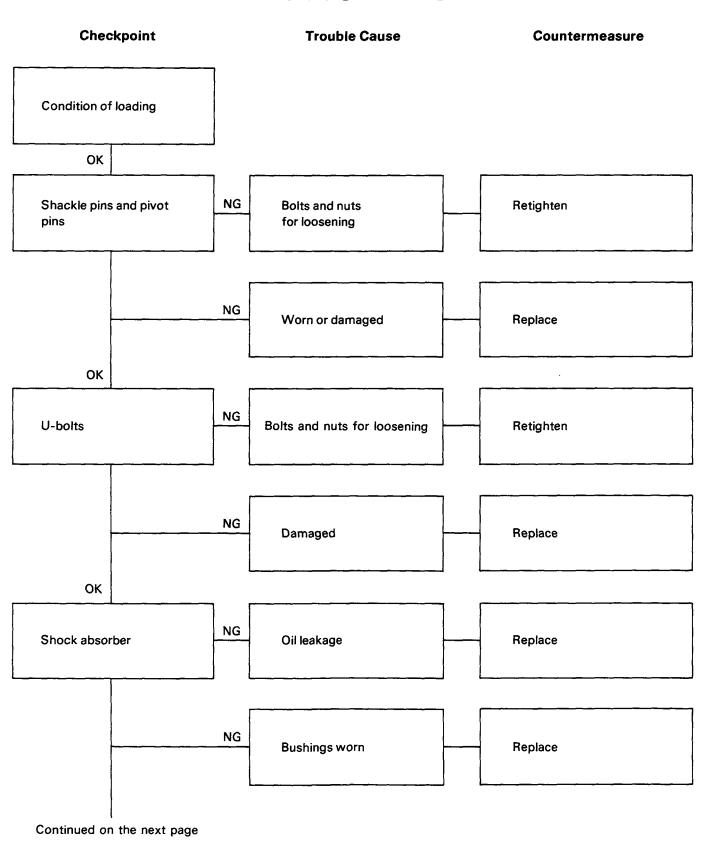
## 2. REDUCTION IN GROUND CLEARANCE

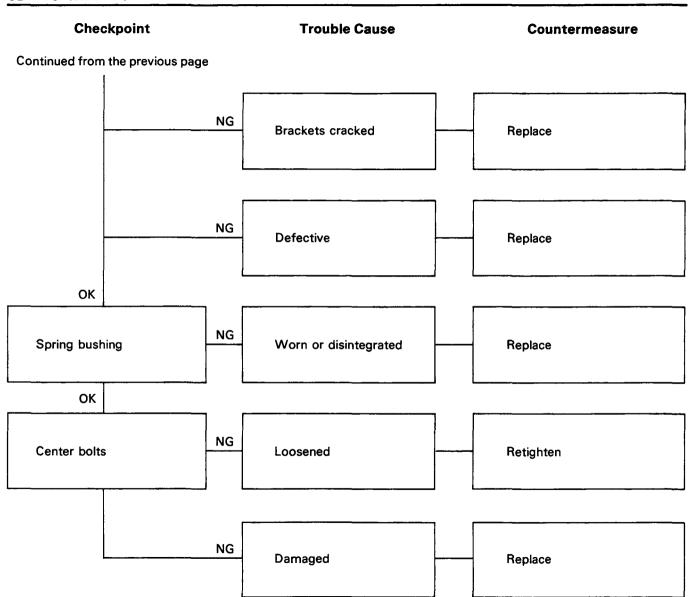


#### 3D-14 REAR SUSPENSION



## 3. SPRING BREAKAGE





Countermeasure

## 4. HARSHNESS

**Trouble Cause** 

Checkpoint

		,	<u></u>		
Road test v (Noise has a	ehicle a certain pattern)	NO	Noise does not have any specific pattern		Replace tires
YES		•		,	
Tire inflation	n pressure	NG	Incorrect		Adjust
ОК				_	
Tires for out	t of balance	NG	Incorrect		Adjust or replace
ОК				_	
Bushings in System	suspension	NG	Defective		Replace
ОК				•	
Bushings in system	suspension	NG	Loosen or broken		Retighten or replace



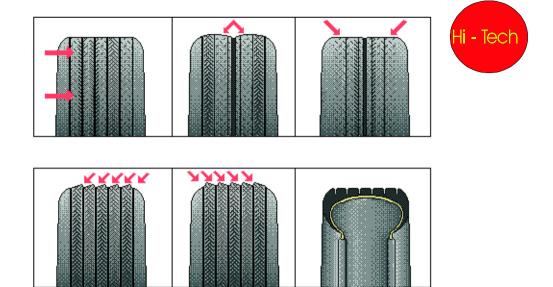


Servicing

Specs.

Tyres

Inspection



# KB TF 140 Wheels and Tyres



# SECTION 3E WHEELS AND TYRES

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## **TYRE PRESSURE DATA**

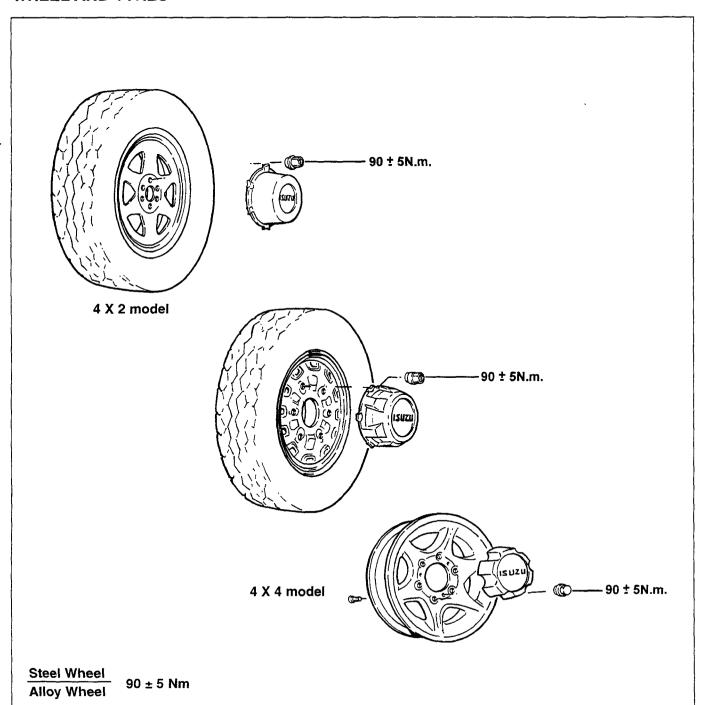
		<del>'</del> -		TYRE PRE	SSURE (k	(Pa)	
				UNLA	DEN	LAD	EN
ITEM MODEL	MODEL CODE	TYRE SIZE	WHEEL SIZE	FRONT	REAR	FRONT	REAR
1 KB200 4X2 SWB/LWB	TFR12F/H	195 R14C	5J X 14	200	220	220	375
2 KB200 4X2 SWB	TFR12FL	205 R14C	6JJ X 14	200	220	220	310
3 KB260 4X2 LWB	TFR17H	195 R14C	5J X 14	200	220	220	375
4 KB260 4X2 SWB	TFR17FL	205 R14C	6JJ X 14	200	220	220	310
5 KB260 4X2 LWB/DCAB	TFR17HL/HDL	215 R15REINF	7JJ X 15	200	220	220	300
6 KB260 4X4 DCAB	TFS17HDL	245/70 R16C	7JJ X 16	200	220	220	300
7 KB260 4X4 LWB	TFS17H	215 R15REINF	7JJ X 15	200	220	220	300
8 KB250 D 4X2 SWB/LWB	TFR54F/H	195 R14C	5J X 14	200	220	220	300
9 KB250 D 4X2 LWB	TFR54HL	205 R14C	6JJ X 14	200	220	220	310
10 KB280 TD 4X2 LWB	TFR55H	195 R14C	5J X 14	200	220	220	375
11 KB280 TD 4X2 SWB	TFR55LL	205 R14C	6JJ X 14	200	220	220	310
12 KB280 TD 4X2 LWB/DCAB	TFR55HL/HDL	215 R15REINF	7JJ X 15	200	220	220	300
13 KB280 TD 4X4 DCAB	TFS55HDL	245/75 R15C	7JJ X 15	200	220	220	300
14 KB280 TD 4X4 LWB	TFS55HL	245/70 R16C	7JJ X 16	200	220	220	300

## **TORQUE SPECIFICATIONS**



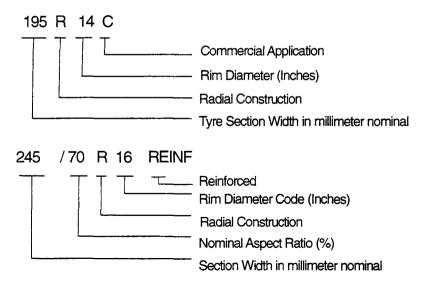
## SPECIAL PARTS FIXING NUTS AND BOLTS

#### WHEEL AND TYRES



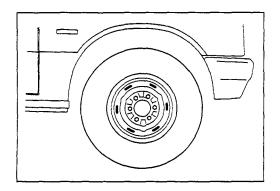
## WHEELS AND TYRES

## **TYRE DESIGNATION (EXAMPLE)**



## **SERVICING**

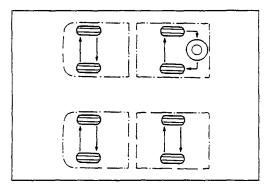
Servicing refers to general maintenance procedures to be performed by qualified service personnel.





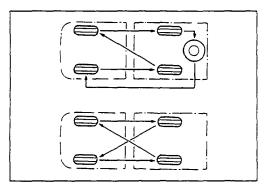
## WHEEL NUT TORQUES

Wheel Nut Torque		N•m
Steel Wheel Alloy Wheel	90 ± 5 Nm	

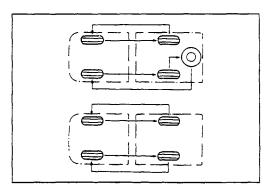


#### TYRE ROTATION

When the front tyre size and the rear tyre size are different, interchange front wheels and rotate the rear wheels as shown in the figure.

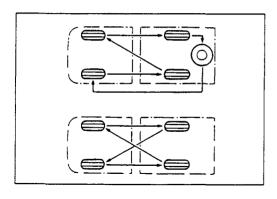


When the front and the rear tyre are the same size, rotate the wheels as shown in the figure.



For of radial tyre interchange the front and the rear wheels on the same side as shown in the figure.

#### 3E-6 WHEELS AND TYRES



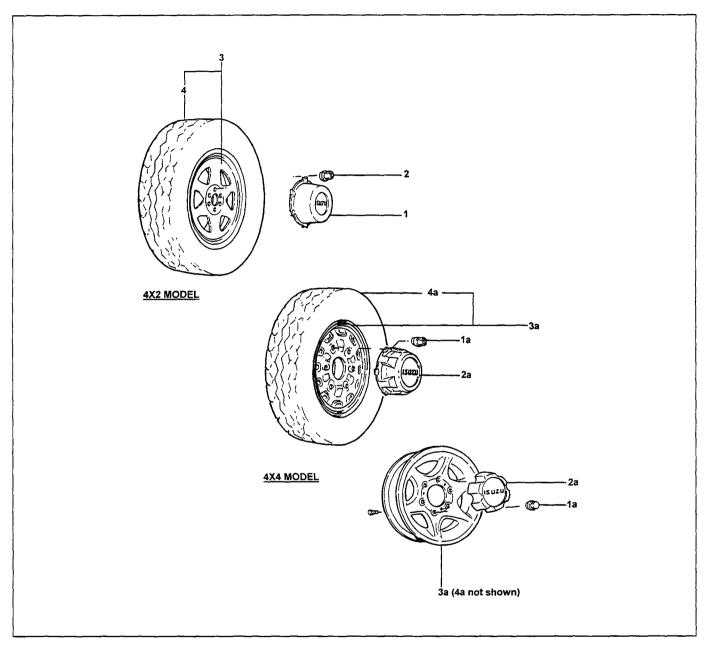
If one-sided tyre wear appears on radial tyre, rotate the wheel as shown in the figure.

#### Note:

After rotation, adjust the front and the rear tyre pressure and be sure to check wheel nut torque.



## **DISASSEMBLY**



## Disassembly Steps (for 4 x 2 model)

- 1. Wheel cap
- 2. Wheel nut
- 3. Wheel and tyre assembly
- 4. Tyre assembly

## (for 4 x 4 model)

- 1a. Wheel nut
- 2a. Center cap
- 3a. Wheel and tyre assembly
- 4a. Tyre assembly



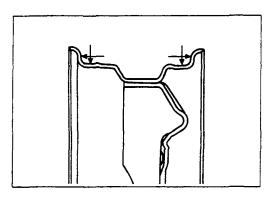
## **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.



#### Visual Check

Inspect all disassembled parts for wear, damage or other abnormal conditions.

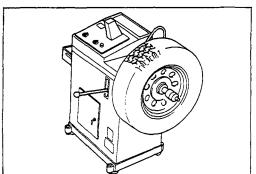




#### Measure Wheel Runout

	mm(in)
Steel	Less than 1.2 (0.047)
Alloy	Less than 0,25 (0.01)

If the measured value exceed the specified limit, the wheel must be replaced.





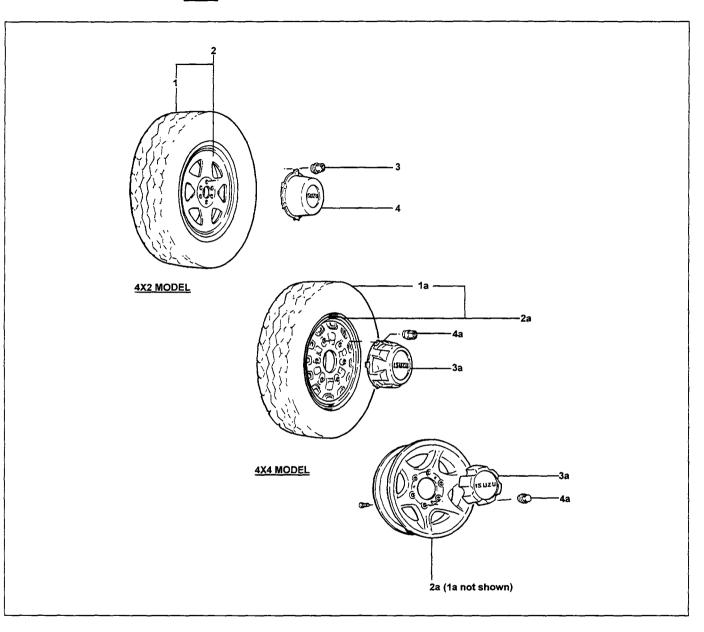
#### Measure Wheel Unbalance

Using a wheel balancing equipment.

Install on the side rim of the wheel a balance weight to offset unbalance.

Balance weight for the wheel should not exceed 170g in total, and 140g is the maximum amount for either side.



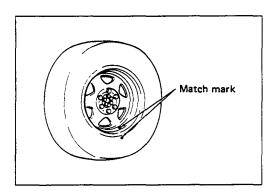


# Disassembly Steps (for 4 x 2 model)

- ▲ 1. Tyre assembly
- ▲ 2. Wheel and tyre assembly
- ▲ 3. Wheel nut
  - 4. Wheel cap

#### (for 4 x 4 model)

- ▲ 1a. Tyre assembly
- ▲ 2a. Wheel and tyre assembly
  - 3a. Center cap
- 4a. Wheel nut





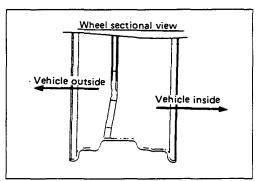
#### **Important Operations**



#### 1 and 1a. Tyre Assembly

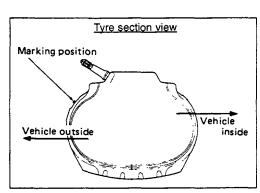
Align sinvolve three belong

Align air valve - tyre balancing match marks (About 8 mm diameter paint mark.)





2 and 2a. Wheel and Tyre Assembly





#### 3 and 4a. Wheel Nut

Tighten wheel nuts in numerical order.

|--|

Wheel Nut Torque Steel Wheel <u>N•m</u>

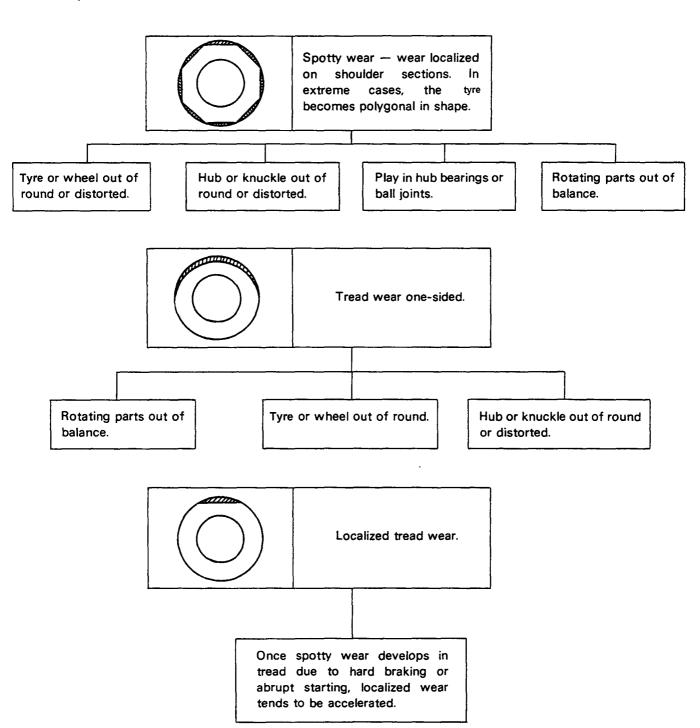
Aluminum Wheel

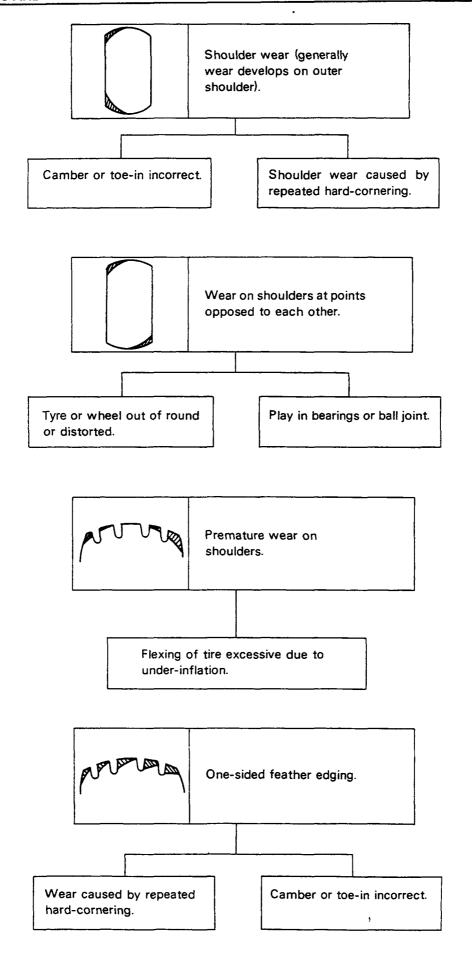
90 ± 5 Nm

Typical examples of abnormal tyre tread wear and major causes:

#### **CAUTION:**

Similar wear patterns can be caused by worn suspension parts, misalignment of wheels and tyres, and other suspension related problems.





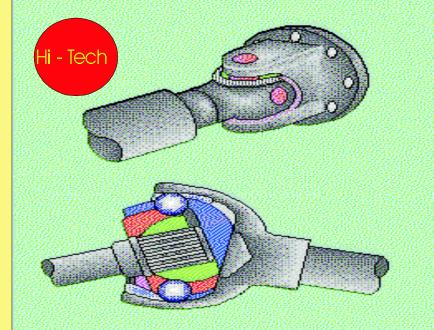


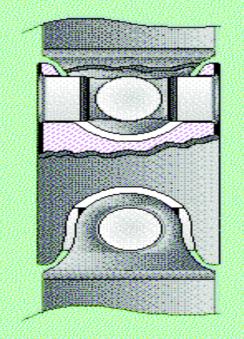
Index

Special Parts

Centre Bearing

**Assembly** 





# KB TF 140 Propshaft

# SECTION 4A PROPELLER SHAFT

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# MAIN DATA AND SPECIFICATIONS REAR PROPELLER SHAFT

mm(in)

4x2 Model

		Short W	heel Base
Engine Model		4ZC1	4JA1
Transmission Type		MT, 5	MT, 5
Outside Diameter	mm	82.6	75.5
	(in)	(3.25)	(2.95)
Inside Diameter	mm	79.4	71.8
	(in)	(3.13)	(2.83)
Length 1st	mm	1293	1278
	(in)	(50.91)	(50.31)
2nd	mm (in)		
Spline Outside diameter	mm	29.87	29.87
	(in)	(1.18)	(1.18)

				Long Whe	eel Base		
Engine Model		42	ZE1	4ZC1	4.	JA1	4JB1T
Transmission Type		MT, 5	AT	MT, 5	MT, 5	MT, 5 (6WF)	MT, 5
Outside Diameter	mm	68.9	68.9	63.5	63.5	68.9	68.9
	(in)	(2.71)	(2.71)	(2.50)	(2.50)	(2.71)	(2.71)
Inside Diameter	mm	64.3	64.3	60.3	60.3	64.3	64.3
	(in)	(2.53)	(2.53)	(2.37)	(2.37)	(2.53)	(2.53)
Length 1st	mm	644.5	565.5	644.5	629.5	644.5	644.5
	(in)	(25.37)	(22.26)	(25.37)	(24.78)	(25.37)	(25.37)
2nd	mm	927	927	949	949	927	927
	(in)	(36.50)	(36.50)	(37.36)	(37.36)	(36.50)	(36.50)
Spline Outside diameter	mm	29.87	29.87	29.87	29.87	29.87	29.87
	(in)	(1.18)	(1.18)	(1.18)	(1.18)	(1.18)	(1.18)

<sup>\*</sup> AT - Automatic Transmission

MT - Manual Transmission, 4 speed and 5 speed

MT, 5 - Manual Transmission, 5 speed

MT, 4 - Manual Transmission, 4 speed

<sup>6</sup>ST - Low gear Rear Axle and Transmission

#### 4x4 Model

		Short Wheel Base			
Engine Model		4 <b>Z</b> C	<b>)</b> 1	4JA1	
Rear Axle size		MT, 5 (6WF)	MT, 5	MT, 5 (6WF)	MT ,5
Outside Diameter	mm	63.5	65	63.5	65
	(in)	(2.50)	(2.56)	(2.50)	(2.56)
Inside Diameter	mm	60.3	59.8	60.3	59.8
	(in)	(2.37)	(2.35)	(2.37)	(2.35)
Length 1st	mm	510.5	449.5	495.5	361.5
	(in)	(20.10)	(17.70)	(19.51)	(14.23)
2nd	mm	608	582	608	582
	(in)	(23.94)	(922.91)	(23.94)	(22.91)
Spline Outside	mm	29.87	29.87	29.87	29.87
diameter	(in)	(1.18)	(1.18)	(1.18)	(1.18)

				Long Whe	eel Base		
Engine Model		4ZE1	4 <b>Z</b> C	:1	4JA	.1	4JB1T
Rear Axle size		MT, 5	MT, 5	MT, 5 (6WF)	MT, 5	MT, 5 (6WF)	MT, 5
Outside Diameter	mm	68.9	63.5	68.9	63.5	68.9	68.9
	(in)	(2.71)	(2.50)	(2.71)	(2.50)	(2.71)	(2.71)
Inside Diameter	mm	64.3	60.3	64.3	60.3	64.3	64.3
	(in)	(2.53)	(2.37)	(2.53)	(2.37)	(2.53)	(2.53)
Length 1st	mm	451.5	510.5	451.5	495.5	482	482
	(in)	(17.78)	(20.10)	(17.78)	(19.51)	(19.00)	(19.00)
2nd	mm	927	949	927	949	927	927
	(in)	(36.50)	(37.36)	(36.50)	(37.36)	(36.50)	(36.50)
Spline Outside diameter	mm	29.87	29.87	29.87	29.87	29.87	29.87
	(in)	(1.18)	(1.18)	(1.18)	(1.18)	(1.18)	(1.18)

<sup>\*</sup> AT - Automatic Transmission

MT - Manual Transmission, 4 speed and 5 speed

MT, 5 - Manual Transmission, 5 speed

MT, 4 - Manual Transmission, 4 speed

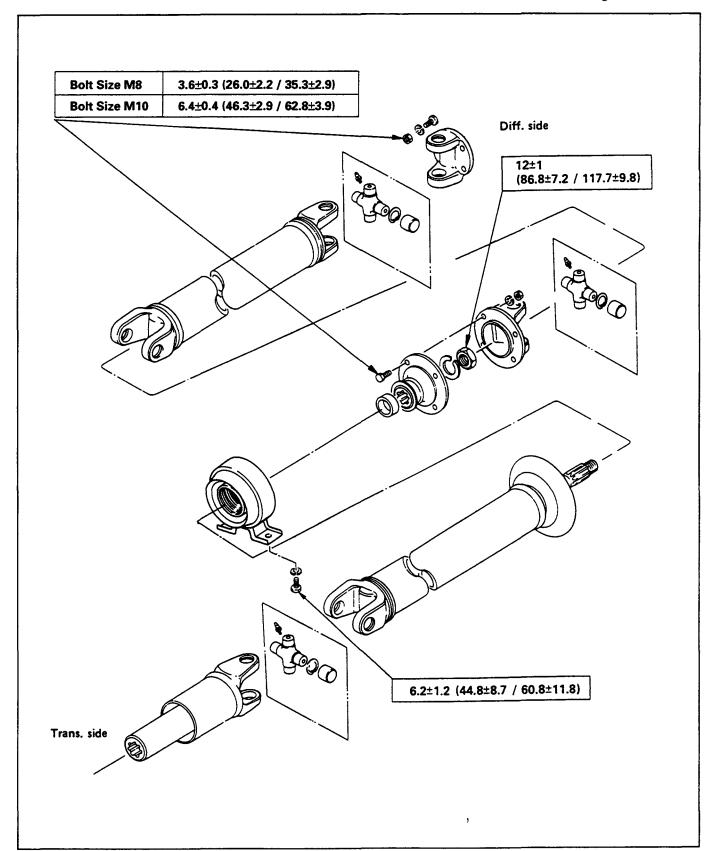
<sup>6</sup>WF - Low gear Transmission



## SPECIAL PARTS FIXING NUT AND BOLT

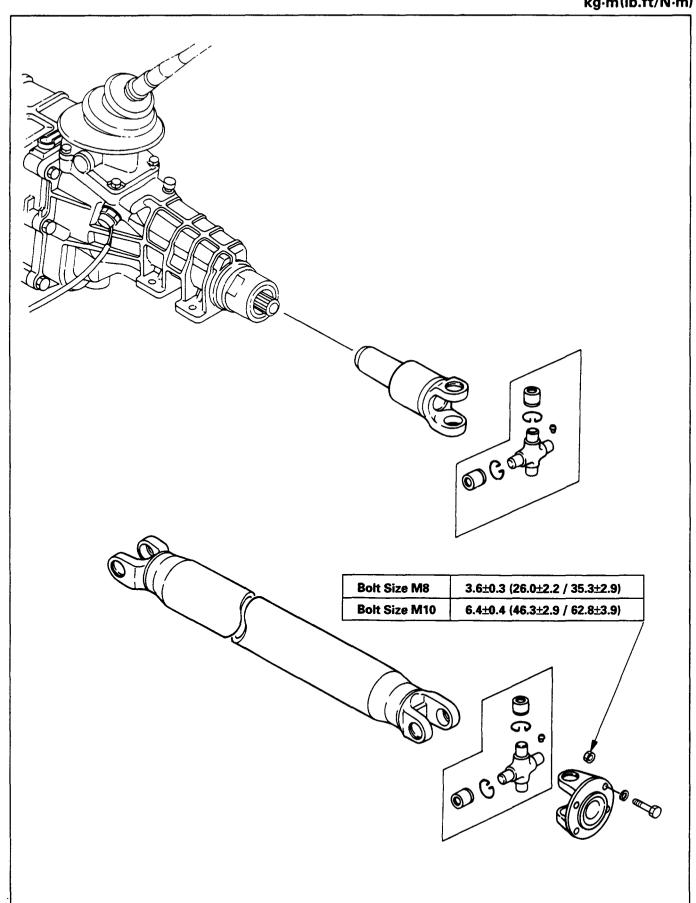
REAR PROPELLER SHAFT (Long Wheel Base Model)

kg·m(lb.ft/N·m)



#### REAR PROPELLER SHAFT (Short Wheel Base Model)

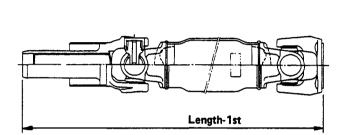
kg·m(lb.ft/N·m)



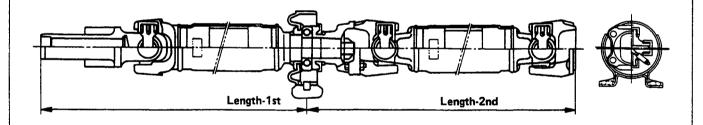
## **PROPELLER SHAFT ASSEMBLY**

#### **GENERAL DESCRIPTION**

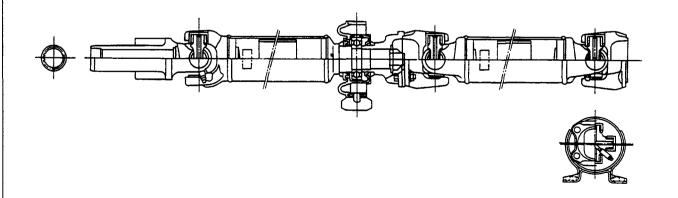
#### **REAR PROPELLER SHAFT**



4 X 2 Long



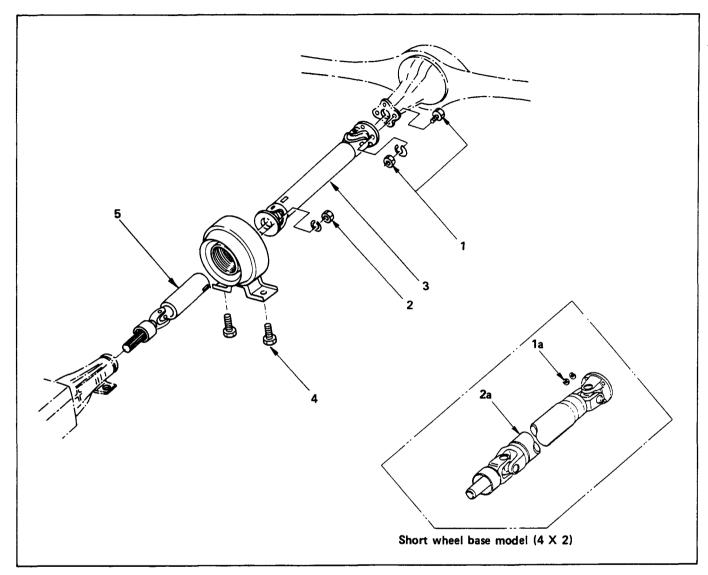
4 X 4



# **++**



#### **REMOVAL AND INSTALLATION**



Since the propeller shaft assembly is carefully balanced, a scribe mark should be made on the flange before removal.

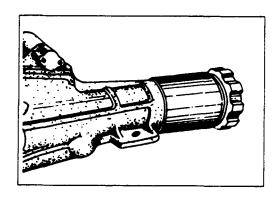
Install the parts by aligning scribe marks made during removal.

#### **Removal Steps**

- 1.1a Bolt; differential side
  - 2. Bolt; flange
- ▲ 2a. Propeller shaft assembly
  - 3. Propeller shaft assembly; 2nd
  - 4. Bolt; center bearing bracket
- ▲ 5. Propeller shaft assembly; 1st

#### **Installation Steps**

- 5. Propeller shaft assembly; 1st
- 4. Bolt; center bearing bracket
  - 3. Propeller shaft assembly; 2nd
- ▲ 2. Bolt; flange
  - 2a. Propeller shaft assembly
- ▲ 1.1a Bolt; differential side





#### Important Operation — Removal

- 2a. Propeller Shaft Assembly
  - 5. Propeller Shaft Assembly: 1st

Install a plug at the transmission rear cover to prevent loss of the transmission oil.



#### Important Operations — Installation



#### 4. Bolt ; Center Bearing Bracket

Bolt Torque	kg·m(lb.ft/N·m)
$6.2 \pm 1.2 (44.8 \pm 8.7/60.8)$	3 ± 11.8)



#### 2. Bolt; Flange

Boit Forque	Kg•m(ID.π/N•m)
Bolt size M10	6.4±0.4 (46.3±2.9/62.8±3.9)
Bolt size M8	3.6±0.3 (26±2.2/35.3±2.9)

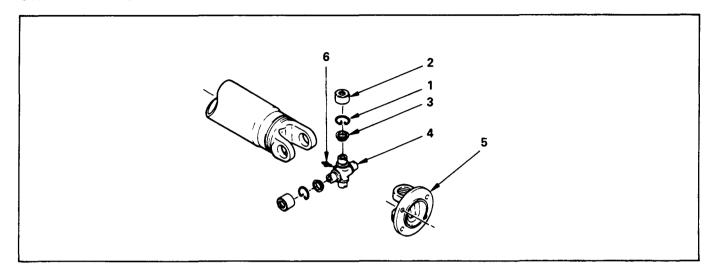


#### 1.1a. Bolt; differential side

<b>Bolt Torque</b>	kg·m(lb.ft/N·m)
Bolt size M10	6.4±0.4 (46.3±2.9/62.8±3.9)
Bolt size M8	3.6±0.3 (26±2.2/35.3±2.9)

# DISASSEMBLY

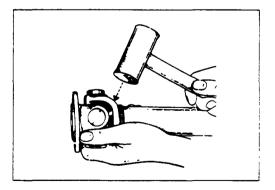
#### **UNIVERSAL JOINT**



#### **Disassembly Steps**

- 1. Snap ring
- ▲ 2. Needle roller bearing
  - 3. Seal

- 4. Spider
- 5. Flange yoke
- 6. Grease fitting (4x4 model only)



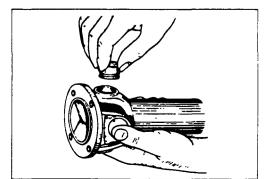


#### **Important Operation**

#### 2. Needle Roller Bearing

(1) Tap out the bearing by gently striking the shoulder of the yoke.

Using a mallet or a copper hammer.



(2) As the yoke is tapped, the needle roller bearing will come out gradually, permitting easy removal by hand.



#### **INSPECTION AND REPAIR**

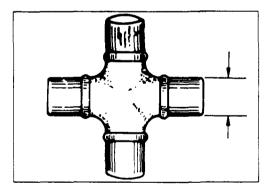
Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

Spider
Needle roller bearing
Yoke
Flange
Center bearing
Cushioning rubber
Bracket



#### **Visual Check**

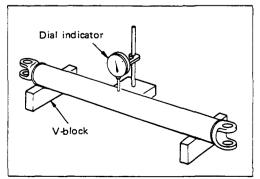
Inspect following parts for wear, damage, or other abnormal conditions.





#### **Outside Diameter of Spider Pins**

	mm(in)
Standard	Limit
17 (0.67)	16.90 (0.665)



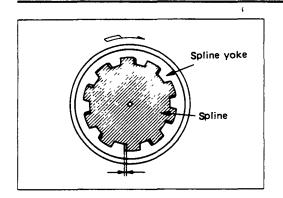


#### **Propeller Shaft Run-Out**

Support the ends of the propeller shaft on V-blocks and check for run-out by holding the probe of a dial indicator in contact with the center part of the shaft.

If the amount of run-out is beyond the standard value for assembly, correct with a bench press or replace the shaft with a new one.

	mm(in.)
Standard	Limit
0.3 (0.012)	0.5 (0.02)

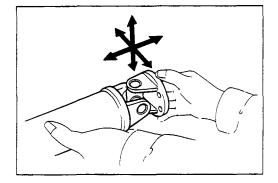




#### Play in the Splines in the Normal Direction of Rotation

Check the amount of play in the sleeve yoke and the propeller shaft splines in the direction of rotation using a pointed feeler gauge.

	mm(in)
Standard	Limit
0.06 — 0.14 (0.002 — 0.006)	0.3 (0.012)





#### Play in Spider Bearing

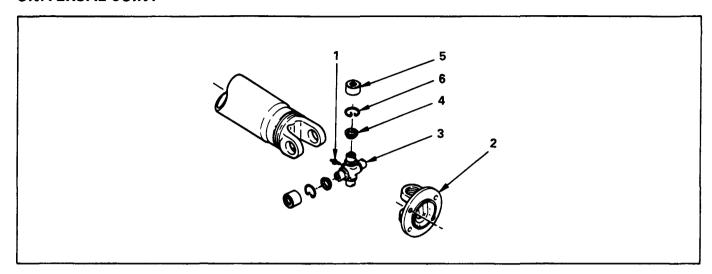
- (1) Check the spider bearings for wear or damage.
- (2) Check the amount of axial and radial play in spider bearing by moving the yoke back and forth on the spider axes and shaft axis.

	mm(in.)
Limit	0.5 (0.02)

If the limit is exceeded, replace the shaft assembly.

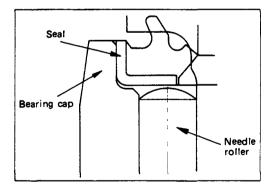


#### **UNIVERSAL JOINT**



- 1. Grease fitting (4x4 model only)
- 2. Flange yoke
- 3. Spider

- 4. Seal
- 5. Needle roller bearing
- 6. Snap ring



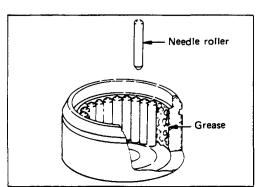


#### Important operations

#### 4. Seal

Discard the used seal and install a new one.

Push the seal in until its outer surface is flush against the bearing cap surface.



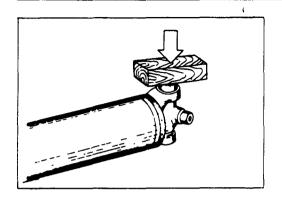
#### 5. Needle Roller Bearing

Apply a molybdenum-disulfide grease or multipurpose type grease NLGI No. 2 to the bearing cap inner surface and seal lip. install the needle rollers.

Amount of grease required

g(oz)

Approx. 1.2 (0.042)



(2) Attach the spider to the yoke and then insert the needle roller bearing cap into the hole by using a wood block and a hammer or a press.

#### 6. Snap Ring

When the bearing cap is in position, select and install a snap ring of suitable thickness so that the end play of the spider pin is held within 0.1 mm. (0.004 in.).

Select the thickest snap ring which can be fitted into the groove at the other end.

mm(in.)

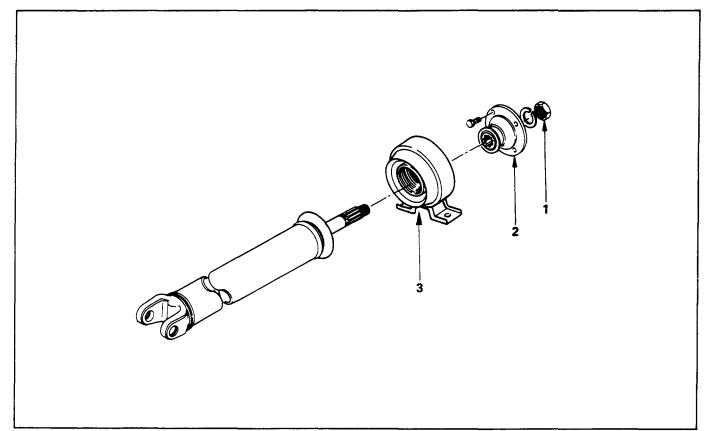
Identify color
Blue
White
Yellow
Green
Not color

#### CENTER BEARING (4ZE1, 4JG2T, 4JB1T, 4ZD1, 4JA1 Engine)





## DISASSEMBLY AND REASSEMBLY

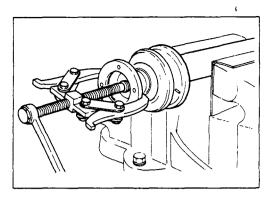


#### **Disassembly Steps**

- 1. Lock nut
- 2. Flange
  - 3. Bearing assembly

#### **Reassembly Steps**

- ▲ 3. Bearing assembly
- 2. Flange
- ▲ 1. Lock nut



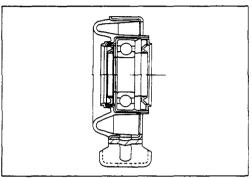


#### Important Operations - Disassembly

### 2.

#### 2. Flange

Use a suitable remover.





#### Important Operations - Reassembly

# 3.

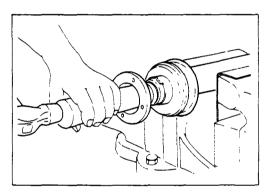
#### 3. Bearing assembly

Clean the bearing fitting face.



Repack the grease.

Amount of grease		Approx. 12 (0.42)
required	g(oz)	, ,

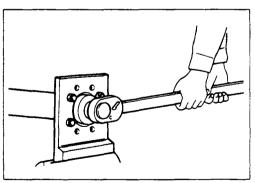




#### 2. Flange

Installer: 5-8522-0034-0

(J-6403-C)





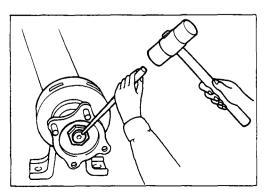
#### 1. Lock nut

Lock nut Torque

kg·m(lb.ft/N·m)

12 (86.8/117.7)

- (1) Discard the flange nut and install a new one.
- (2) Stake the outer face of the flange nut against the slot in the shaft.











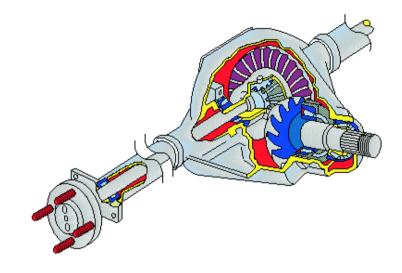




Servicing

Specs.

Shaft



# KB TF 140 Rear Axle



PAGE

# SECTION 4B REAR AXLE

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Main data and specifications...... 4B- 4

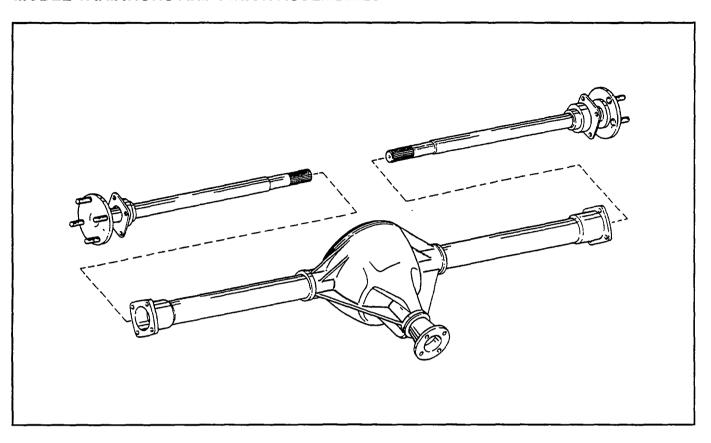
In-car adjustment and repairs       48–10         Rear wheel oil seal replacement       48–12         Drive pinion oil seal       48–12         Drive pinion seal replacement       48–16         Off-car repairs       48–16         Gear tooth contact patterns       48–16         Tooth contact pattern adjustment       48–17         Pinion spacer thick       48–17         Pinion spacer too thin       48–18         Gear too close to pinion       48–18         Gear too far from pinion       48–18         Inspection after removal and disassembly       48–18         Inspection after removal and disassembly       48–18         Gearing cups       48–20         Cone and roller assemblies       48–20         Drive pinion flange       48–20         Carrier casting       48–20         Carrier casting       48–20		
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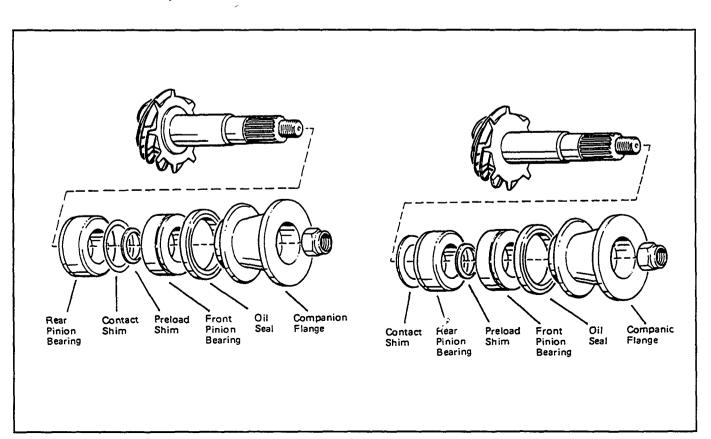
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#### **MODEL VARIATIONS AND PINION ASSEMBLIES**



#### **TYPICAL MODEL 80, 75 AXLES**



#### MAIN DATA AND SPECIFICATIONS

Ring gear and pinion	Model 80	Model 75 and 76
Backlash (tightest point)	0,13 to 0,21	0,13 to 0,21
Variation between teeth	0,08 mm all	models
Bearing pre-load	Model 80	Model 75 and 76
Differential	1,1 to 2,2 kg	1,1 to 2,2 kg
Pinion with seal	2,0 to 3,0 Nm	1,7 to 2,5 Nm
Pinion without seal	1,9 to 2,9 Nm	-

#### **IMPORTANT:**

THESE PRE-LOADS ARE APPLICABLE TO NEW BEARINGS ONLY WITHOUT OIL. IF OILED REFER PAGE 22. WITH USED BEARINGS, DO NOT EXCEED 1,0 Nm ON PINION OR DIFF BEARINGS.

Lubrication	Model 80	Model 75	Model 76
*Oil fill	1,6 litres	1,4 litres	1,5 litres

ALWAYS FILL TO THE LOWER EDGE OF THE FILLER PLUG HOLE WITH THE VEHICLE ON LEVEL GROUND.

Tightening torque	Model 80, 76	Model 75
Bearing cap bolts	60 - 70 Nm	47 - 61 Nm
Pinion nut*	245 - 345 Nm	*
Cover bolts	16 -	23 Nm
Filler/Drain plug**	60 - 70 Nm	
	MODEL 80,76,75	
Ring gear bolts	115 - 125 Nm	

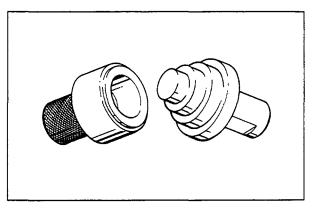
<sup>\*</sup>FOR COLLAPSIBLE SPACER MODELS TIGHTEN TO PRE-LOAD TORQUE SPEC.

<sup>\*</sup>THESE FIGURES ARE APPROXIMATE FILL QUANTITIES ONLY.

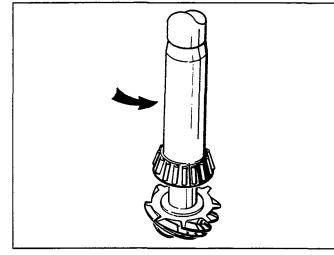
<sup>\*\*</sup>FOR DRAIN PLUGS APPLY LOC-TITE STUD LOCK.

# **SPECIAL TOOLS**

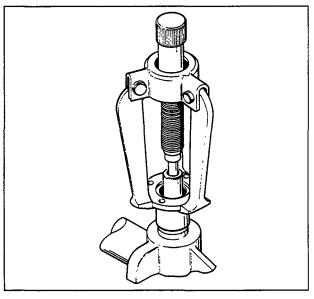
TOOL	TOOL No.	MODEL ADDITION	
	5144-5007	MODEL APPLICATION All axles	
Sliding hammer	5437-5005		
Wheel bearing puller	or standard tool	All axles	
Wheel bearing press dolly	5437-5007	35 mm bearing	
Wheel bearing oil seal installer		35 mm ball bearing	
Pinion oil seal installer	5397-5031	M75	
Fillion on seal installer	5144-5071	M80, M76	
Stub shaft oil seal installer	5378-5071	Model 76	
Bearing and flange puller	5376-5001	All models	
bearing and hange punct	or standard tool	All Hodels	
Ring pinion bearing	5414-0124	All models	
Puller (two piece)	5414-0158	All Hiodels	
Diff bearing press dolly	5414-5018	M75, M76	
Din bearing press doily	5144-5082	M80, M76	
Rear pinion bearing	5144-5075	M80	
Cone press only	5144-5080	M76	
conc proce oray	5414-5005	M75	
Pinion bearing cup installer	5144-5072	M80	
· ····································	5144-5077	M76	
	5375-5049	M75	
Pinion bearing cup	5375-5092	M75	
Extractor	5375-5050	M80	
	5144-5078	M76	
	5144-5083	M80	
	5144-5079	M76	
Alternate extractor (drift)	5605-5392	M80	
Carrier holder/crusher	5437-0200	All axies	
or Carrier spreader	5437-5017	All axles	
Plus attachment plates	5375-5203	M80, M76, M75	
Depth gauge cylinder	5151-5038	M75, M76, M80	
Dummy pinion	5397-5386	M75, M76	
-	5144-5069	M80	
Rear bearing setting gauge	5397-5146	M75, M76	
	5144-5074	M80	
Rear bearing setting master	5283-5064	M75, M76	
	5144-5073	M80	
Diff bearing assembly tools	5378-5038	M75, M76, M80	
		FLANGE PART NO.	P.C.D.
Flange retaining spanner	5144-5002	06 75 031 027	77.8
		06 75 031 006	80.0
	5144-5070	06 75 031 028	89.98
		06 80 031 002	89.98
	5144-5012	06 75 031 006	80.0
	5144-5081	06 75 031 025	104.6
	5144-5076	06 76 031 002	75.0
Gear marking compound	06 00 410 001		
Gauge plate size:	500 mm x 200 mm x 10 mm		



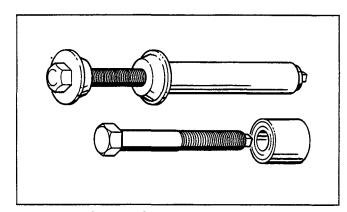
Wheel bearing oil seal installer Pinion oil seal installer



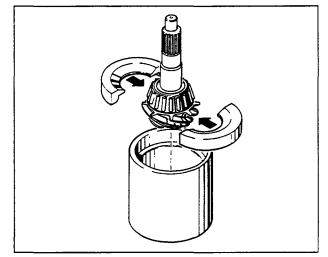
Rear pinion bearing



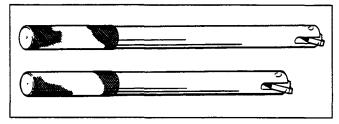
Bearing and flange puller



Pinion bearing cup installer



Ring pinion bearing



Pinion bearing cup



Alternate extractor

# IDENTIFICATION, DESCRIPTION AND OPERATION

#### IDENTIFICATION

An identification tag with the axle assembly part number, axle serial number and axle ratio is fixed to the lower rib of the carrier casting.

#### **DESCRIPTION**

The rear axle is of the hypoid type using shim adjustment to obtain bearing pre-loads and gear adjustment. The differential case with ring-gear, and the drive pinion are mounted in opposed taper roller bearings in the one piece rear axle carrier.

The rear axle drive pinion receives its power from the engine through the transmission and drive shaft. The drive pinion rotates the differential case through engagement with the ring gear, which is bolted to the differential case flange. Inside the differential case are two differential pinions mounted on the differential pinion shaft which is pinned to the housing. These gears are engaged with the side gears, to which axle shafts are splined. Therefore, as the differential housing turns, it rotates the axle shafts and rear wheels. When it is necessary for one wheel and axle shaft to rotate faster than the other, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow differential action between the two axle shafts.

For rigid axles of the semi-floating type, the axle shafts are held in the axle bearings and retainers at the housing outer ends. Axle shaft end play is pre-set and is not adjustable.

All operations other than removal of the axle shafts and the replacement of the wheel bearing, wheel oil seal or stub shaft oil seal should be carried out with the axle removed from the vehicle. It is possible on some vehicles to change the pinion oil seal as well, but in other cases space restriction make this undesirable.

#### **CARE OF THE AXLE**

The lubricant level should be checked every 10 000 km with the vehicle unladen and on level ground. The oil should be at the lower edge of the filler plug hole.

It is generally unnecessary to periodically drain the axle lubricant. The factory fill may remain in the axle for the life of the vehicle, except when repairs are made, or when recommended by the vehicle manufacturer.

It is important that the lubricant specified by the manufacturer is used. Should it be suspected that the axle has shipped water, the axle should be drained and refilled with the recommended lubricant.

#### DIAGNOSIS AND TESTING

#### **DIAGNOSIS GUIDE**

Certain rear axle and drive line trouble symptoms are also common to the engine, transmission, tyres and other parts of the car. For this reason, be sure that the cause of the trouble is in the rear axle before adjusting, repairing or replacing any of the axle parts.

#### **REAR AXLE DIAGNOSIS**

Noise in a rear axle is more difficult to diagnose and repair than mechanical failures. Slight axle noise heard only at a certain speed or under particular conditions must be considered normal. Axle noise tends to peak or be more pronounced at particular speeds and the noise is in no way a sign of trouble in the car. Where noise is present in an objectionable form (load and/or at all speeds) the first effort should be to isolate the noise. Isolation of the noise in any one unit requires care and experience and an attempt to eliminate a slight noise may baffle even the expert.

Axle noises fall into two basic categories, gear noise and/or bearing noise.

#### **DEFINITION OF DRIVING MODES**

During the testing of the axle, noise will occur in different driving modes.

When power is delivered from the engine to the wheels, this is termed "drive".

"Drive" mode is also experienced when climbing hills accelerating or maintaining constant speed on a level road.

"Coast" mode is encountered when the vehicle moves against engine compression as when slowing down or descending a hill.

In some cases noise is detected in a 'float' condition.

This is a rare condition and is difficult to maintain as it is between drive and coast and occurs momentarily.

The most important characteristic of gear noise is that it is usually sensitive to throttle position; e.g. noise audible under drive condition will often disappear under coast conditions at the same vehicle speed and vice-versa.

Axle gear whine will always occur at the same road speed and throttle setting i.e. drive or coast. Gear whine is usually a fairly high pitched pure tone as opposed is usually a fairly high pitched pure tone as opposed to a low pitched rumble caused by a spalled bearing.

Some noises which can be confused with axle gear whine are:-

- Whine from an engine component, this always occur at the same engine speed irrespective of which transmission gear is used.
- Whine from an indirect transmission gear (e.g. 5th gear on some vehicles produces a whine comparable when the direct transmission ratio is selected.
- Whine from tyres or wind noise from a roof rack or aerial. These noises generally occur over a very broad speed range and do not change with driving mode i.e. drive or coast.

# REMEMBER: BEFORE DIAGNOSING THE WHINE AS AXLE GEAR NOISE, ENSURE THAT THE WHINE:

- 1. Occurs in direct transmission ratio (4th gear).
- 2. Changes with throttle variations (drive and coast).
- Always occurs at the same road speed and not engine speed.
- Occurs over a limited vehicle speed range. (This can vary and be over a wider band should the axle be in extremely poor condition).

#### **BEARING NOISE**

Bearing noise is inclined to be less throttle sensitive than gear noise and frequently occurs over a wider speed range, bad cases of faulty bearings can, in fact, be detected from walking speed, building up in pitch as speed increases and is not affected by changing from drive to coast and vice-versa.

- 1. Rear wheel bearing noise tends to be a low pitched grumble, which can normally be detected and confirmed when driving on a smooth road at constant speed, with the noise most audible while swerving sharply from the left to right. If the noise decreases or increases as the car is swerved, it is probable that a wheel bearing is faulty. A further check for wheel bearing noise can be carried out by driving close to a wall or a curb at a suitable speed. The noise of a faulty bearing will normally be reflected back and will clearly audible through the open window of the car.
- Differential bearing noise is usually similar in pitch to wheel or bearing noise but not affected by the swerve check referred to previously.
- Pinion bearing noise is normally at a higher pitch than wheel or differential bearings and is often slightly sensitive to throttle position, although not to the same extent as gear noise.

#### **OTHER**

A further condition which can exist is gear noise caused by a worn bearing which allows the gearset to move out of its correct mesh.

This condition is usually throttle sensitive, with the noise frequently disappearing on a "drive" condition.

Any amount of "float" or end play in either the pinion bearings or differential carrier bearings is detrimental to the gears and bearings and will cause axle noise.

A high spot sometimes occurs on either the ring gear or the drive pinion; this shows up as a ticking or light knocking noise over a restricted range of throttle positions. The frequency of the noise will indicate whether the high spot is on the pinion (drive shaft frequency) or on the ring gear. The severity of the noise indicates the size of the defect. A light 'tick' is seldom detrimental and usually occurs in a new axle only and will normally disappear once the axle has been run in.

Louder noises usually indicates a more serious defect and a knock occurring in an axle which was previously free from this type of noise must always be investigated.

#### **IN-CAR ADJUSTMENTS AND REPAIRS**

REAR AXLE SHAFT, WHEEL BEARING AND INNER BEARING RETAINERS AND WHEEL BEARING OIL SEALS This section applies to ball and 'unit' (taper roller) bearings on

This section applies to ball and 'unit' (taper roller) bearings on rigid axles.

- 1. Remove the wheel and tyre from the brake drum.
- Remove any screws that secure the brake drum to the axle flange and then remove the drum from the flange.
- 3. Working through the hole provided in the axle shaft flange, remove the four bolts that secure the outer wheel bearing retainer. Then pull the axle shaft assy out of the axle housing using an axle shaft removal hammer. The brake carrier plate must not be dislodged. Install one bolt to hold the plate in place after the axle shaft is removed.
- 4. If the rear wheel bearing or outboard seal fitted with unit taper bearing is to be replaced, loosen the inner retrainer. The retainer will become loose on the shaft, if it is chiselled deeply in several places.

CARE MUST BE TAKEN TO AVOID DAMAGE TO THE SHAFT SEAL SURFACE OR BEARING SEATING.

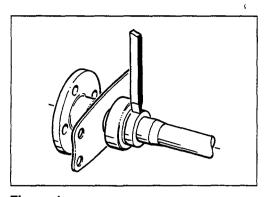


Figure 1

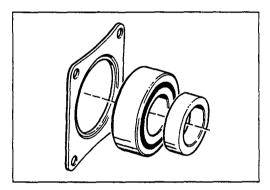


Figure 2

- 5. On M75 passenger car axles, a 35 mm I.D. X 72 mm outer diameter ball bearing and inboard oil seal is used. This seal is located in the tube flange and the bearing gas greased seals on both sides. To remove the bearing, chisel the inner retainer as described in 4 and press off the bearing. (Fig. 1).
- 6. All M75/M20/M80 commercial axles use a 'unit' taper roller bearing which incorporates an outboard oil seal, secured by the outer bearing retainer. These bearings do not have greased seals as they rely on lubrication from the axle lubricant in the axle tubes. If this type of bearing is removed, the oil seal should be replaced as well.
- 7. Chisel the retainer ring as shown in Fig. 1 and then press the bearing from the shaft in a suitable hydraulic press.

Note: This bearing must be discarded.

- Inspect the machine surface of the axle shaft and the axle housing for rough spots or other irregularities which would affect the sealing action of the oil seal. Carefully remove any burrs or rough spots.
- It is important that the outer retainer is not excessively deformed, as the retainer is used to restrict movement of the shaft's bearing and seal arrangement during operation.
- 10. Press a new rear wheel bearing onto the shaft until the bearing seats firmly against the shoulder on the shaft.

IMPORTANT: PRESSURE MUST BE APPLIED THROUGH THE INNER BEARING RING ONLY. NOTE ALSO THAT MOST BEARINGS MUST BE INSTALLED FACING IN A SPECIFIC DIRECTION, IN THE CASE OF 30 mm I.D. BALL BEARING, THIS IS WITH THE INNER RING EXTENSION TOWARDS THE SHAFT FLANGE. IN THE CASE OF THE UNIT TAPER BEARING, WITH THE MAIN CUP TOWARDS THE INNER (SPLINED) END OF THE SHAFT.

- 11. Press a new inner retainer onto the shaft until the retainer seats firmly against the bearing.
- 12. Slide the axle shaft into the housing.
- 13. Start the axle splines into the side gear and push the shaft in until the bearing bottoms in the housing.
- 14. Install the outer bearing retainer and the bolts that secure it, taking care to tighten the bolts evenly. Torque the bolts to the required specification.

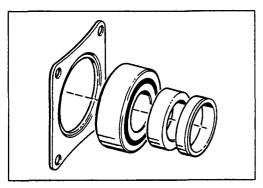


Figure 3

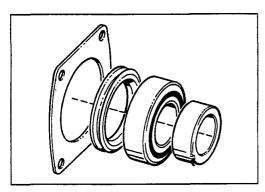


Figure 4

15. In some cases the taper roller bearing cup may separate from the cone whilst installing the shaft. These bearings may be re-used provided care is taken in locating the loose rib ring when assembling the outer retainer.

#### REAR WHEEL OIL SEAL REPLACEMENT

Two main seal configurations are used on Borg-Warner rear axles. They are as follows:-

#### Inboard oil seal

M75 Passenger axles having the 35 mm I.D. x 72 mm ball wheel bearing, use an inboard oil seal in the tube flange housing. (see Fig. 3).

#### To replace this oil seal:-

- 1. Lever out the old seal taking care not to damage the housing bore.
- Clean and inspect the shaft journal for scratches, nicks etc.
- Install the new oil seal with a garter spring inboard using the installation tool. This tool will correctly posi tion the oil seal relative to the bearing and flange face.

#### Outboard oil seal

This seal is fitted to the M75/M20/M80 commercial axles using the unit taper roller wheel bearings. (see Fig. 4).

- Remove the bearing and inner retainer as described on page 4 item 4 and page 5 item 7 and discard these components.
- 2. Replace the oil seal with the garter spring inboard.
- 3. Install a new wheel bearing and inner retainer.

#### DRIVE PINION OIL SEAL

NOTE: RECENT AXLES FROM GEARMAX HAVE COLLAPSIBLE PINION SPACERS IN PLACE OF THE PREVIOUS SOLID PRE-LOAD SHIM.

It is important that the guidelines below are followed when servicing pinion seals with the axle in the vehicle. To identify the axles containing collapsible spacers, the following table display the axle model (M75) as well as the part number (the three digits preceding the serial number) from which model the collapsible spacer is introduced. All part numbers listed below and higher will use the collapsible spacer. In addition, the letters on the serial tag are printed in red when collapsible spacers are used, and black for current solid preload shim models.

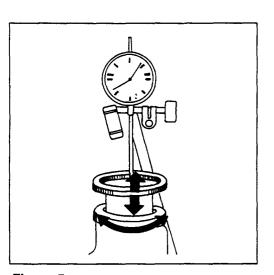


Figure 5

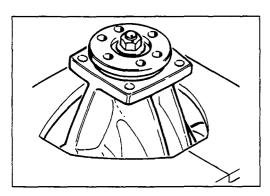


Figure 6

AXLE MODEL	PART NUMBER
AXLE TYPE	FROM THIS NO. AND HIGHER
M68	FROM PREFIX 171 - COLLAPSIBLE
M70	FROM PREFIX 150 - COLLAPSIBLE
M71	FROM PREFIX 050 - COLLAPSIBLE
M75	FROM PREFIX 250 - COLLAPSIBLE
M76	FROM PREFIX 034 - COLLAPSIBLE

	85 BC 4006 AA
SERIAL No.	oM71 RATIO 4.110
PREFIX	<b>→</b> 053 − 01001
	1

#### **METHOD**

- 1. Remove the drive shaft from the axle.
- Check for pinion bearing END FLOAT as follows:
  - (a) Mount a dial indicator on the axle and if necessary, secure it with a clamp.
  - (b) Locate the stylus point on the end of the pinion.
  - (c) While rotating the flange back and forth through approximate 45 degrees, lift the companion flange. Zero the dial indicator while maintaining the load on the pinion. Repeat the back and forth movement while pressing against the flange. (see Fig.5).
  - (d) IF ANY END FLOAT EXISTS, the axle must be removed from the vehicle for further inspection.
- 3. Check the pinion nut ON TORQUE. (For this purpose an indicator type torque wrench is preferred rather than the clicker type).
  - Should the nut torque be substantially lower than the specifications, (eg. below 150 Nm) the axle should be removed for further inspection.
  - CARE MUST BE TAKEN WHEN CHECKING THE ON-TORQUE THAT THE NUT IS NOT TIGHTENED WHICH MAY CAUSE AN INCORRECT PRE-LOAD SETTING.
- 4. If items 2 and 3 are O.K., measure the PINION PRE-LOAD TORQUE for reference only, (axles with higher mileage will show lower readings and are difficult to measure accurately) mark the pinion end, pinion nut and companion flange also noting the number of threads that protrude through the pinion nut. This will make it possible for the pinion nut to be tightened to exactly the same position on re-assembly. (see Fig. 6).
- Remove the pinion nut and companion flange as shown in Fig. 7. Remove the oil seal taking care not to damage the housing bore.

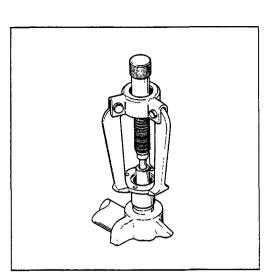


Figure 7

- 6. Inspect the companion flange for defects as described below
- 7. If the companion flange is to be RE-USED, install a new oil seal using the relevant service tool. Align the marks on the companion flange and pinion end and install the flange. Should the flange require REPLACEMENT, the axle must be disassembled and the collapsible spacer and pinion bearing replaced.
- 8. Tighten the pinion nut carefully ensuring that the alignment marks on the pinion and nut are not tightened past the original position. Re-check the pinion pre-load torque. There should be no large differences to the resultant measurement compared to the reading taken in 4.

#### **DRIVE PINION SEAL REPLACEMENT**

- 1. Hold the companion flange with the flange retaining spanner and remove the pinion nut.
- 2. Remove the companion flange using the appropriate puller. (Fig.7).
- 3. Remove the pinion oil seal, taking care not to damage the housing bore.
- 4. Clean and inspect the companion flange.
- 5. Using the installation tool, install the new oil seal into the housing.

#### NOTE: TWO TYPES OF PINION OIL SEALS ARE USED:

- (a) Metal case pinion oil seal. This seal should be flush with the carrier face.
- (b) Standard rubber case seals should be fitted flush to 0,25 mm below the carrier face.
- 6. Install the companion flange.
- 7. Install the pinion nut while restraining the companion flange, tighten the pinion nut to the specified torque. (Fig. 8).

#### **IMPORTANT:**

#### **ALL OIL SEAL REPLACEMENTS**

The presence of scratches or burns in the carrier or tube flange bore can cause a leak around the O.D. of the seal. Scratches, nicks, bumps or burrs on the companion flange, or axle shaft ground journals usually result in seal failure. Be sure to inspect these surfaces carefully for damage. In case where slight damage exists:

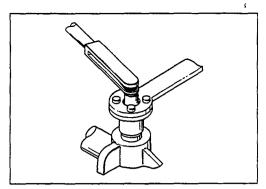


Figure 8

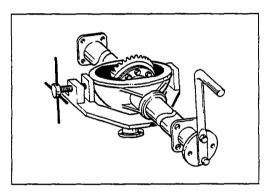


Figure 9

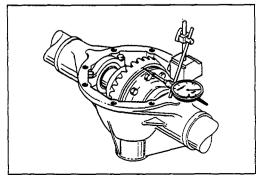


Figure 10

#### In the carrier bores:

Remove the worst damage with medium emery cloth and apply an oil resistant sealer or gasket compound.

#### For journal damage:

If the scratch is very light, use a 600 grit emery paper and polish the shaft in a circumferential direction only. Avoid any helical or axial marks while polishing as this will enable the oil to bypass the oil seal lip.

Should the damage be deeper, the shaft or flange must be replaced.

N.B. ENSURE DEBRIS FROM EMERY CLOTH/PAPER DOES NOT ENTER THE AXLE ASSEMBLY.

#### **OFF-CAR REPAIRS**

# INSPECTION OF DIFFERENTIAL AND DRIVE PINION BEFORE DISASSEMBLY

The existing components should be inspected before they are removed from the housing. These inspections can help to find the cause of the trouble and determine the corrections needed.

Remove the rear cover, wash the oil from the components using a suitable solvent, and visually check for obvious wear or damage to the ring gear and differential case. The gearset teeth should be as oil-free and dry as possible to obtain a good tooth contact pattern.

Rotate the gear to see if there is any roughness which would indicate defective bearings or damage gear teeth. At this point, measure differential pre-load and ring gear backlash as preferred to on page 16. If a zero pre-load condition is noted, ascertain whether end float exists across the differential bearings. If play exists this would indicate worn bearings.

If no obvious defects are noted check the gear tooth contact pattern. Paint the gear teeth thinly with the specified marking compound. Wrap a cloth around the companion flange and grip firmly by hand to brake its rotation while driving the gear through one side shaft. (Fig. 5).

At the same time the opposite side shaft should be locked to prevent its rotation. In this way a torque is applied to the gears whilst being rotated.

Rotate the gears in both directions.

Certain types of gear tooth contact patterns on the ring gear indicating incorrect can often be corrected by re-adjusting the gears.

Typical patterns and the necessary corrections are explained within the following section.

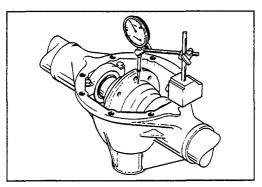


Figure 11

#### Gear tooth contact inspection

Gear toot runout can sometimes be detected by an erratic pattern on the teeth. However, a dial indicator should be used to measure the runout of the back face of the ring gear, (Fig. 10) with the maximum permissible amount being 0,08 T.I.R. (total indicator reading i.e. from one extreme of the indicator needle to the other).

# NOTE: EXCESSIVE RUNOUT DOES NOT NECESSARY MEAN THAT THE GEAR IS AT FAULT.

This runout can be caused by:

- (a) Dirt under the ring gear seat.
- (b) Loose ring gear bolts
- (c) Faulty differential case (i.e. distorted flange or journal)

If the differential case is suspect, remove the ring gear and using a dial indicator, as shown in (Fig. 11), measure the journal runout. This may not exceed 0,05 mm T.I.R. Before discarding such a differential case, check the flange for dirt, burrs or high spots.

#### **GEAR TOOTH CONTACT PATTERNS**

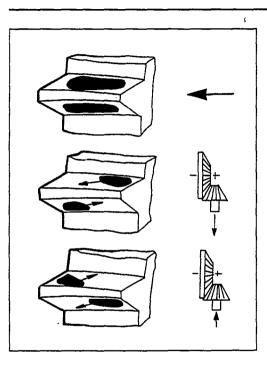
#### PATTERN CHECK

In general, ideal tooth contact patterns should have the following characteristics:-

- 1. The drive pattern should be fairly well centred on the tooth with a slight displacement towards the toe.
- 2. The coast pattern should be centred and the tooth.
- 3. Some clearance between the pattern and the edges of the tooth is essential.
- 4. There must be no hard lines where the pressure is high.
- 5. The length of the patterns should be at least 50% of the tooth width.

Individual gear sets do not necessarily conform exactly to the ideal pattern and individual gear sets of the same type will show patterns that are acceptable yet different from the desired ideal.

The patterns shown below are typical of gear sets that have either an incorrect backlash, or an incorrect shim adjustment. Since each gear set rolls a characteristic pattern, these patterns should be considered as typical only and thus should be a guide rather than a rigid standard. The drive pattern is rolled on the convex side of the tooth and the coast pattern is rolled on the concave side.



#### **CROWN WHEEL TOOTH PATTERN**

#### TOOTH CONTACT PATTERN ADJUSTMENT

#### **CORRECT ADJUSTMENT**

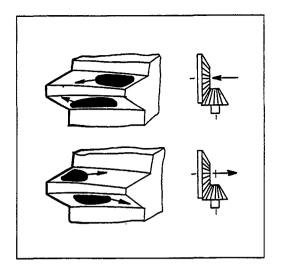
#### PINION SPACER TOO THICK

Use Thinner Pinion adjustment shim. DRIVE Pattern moves toward the top of tooth and toward the heel.

COAST Pattern moves toward toe.

#### **PINION SPACER TOO THIN**

Use Thicker Pinion adjustment shim. DRIVE Pattern moves lower on the tooth and toward the toe. COAST Pattern moves lower on the tooth and slightly toward the heel.



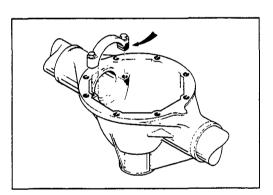


Figure 12

#### **GEAR TOO CLOSE TO PINION**

Move Gear away from pinion to increase backlash. Drive Pattern moves slightly higher and toward the heel. COAST Pattern moves slightly higher and toward the heel.

#### **GEAR TOO FAR FROM PINION**

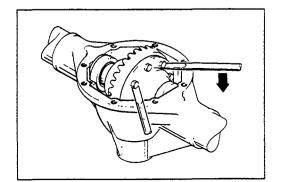
Move Gear closer to pinion to decrease backlash. DRIVE Pattern moves slightly lower and toward the toe. COAST Pattern moves lower and toward the toe.

As pinion adjustment shim changes will affect backlash slightly, move gear closer to pinion after using thinner shim and move gear away from pinion after using thicker shim if necessary.

Pinion adjustment is made after examining tooth pattern on correct backlash setting and with the pinion set at correct pre-load.

# DIFFERENTIAL CASE AND DRIVE PINION REMOVAL

 Remove the differential bearing cap bolts and bearing caps; note that the bearing caps are not interchangeable and that they must be marked to ensure that they are returned to their original positions. (A paint flash on the L.H. cap and adjacent carrier is applied by the factory). (Fig. 12).



 If a table top bench spreader is not available, install the carrier spreader plates and the spreader tool. Spread the carrier to release any clamp on the differential bearings (N.B. MAXIMUM SPREAD 0,5 mm).

Use two tyre levels and remove the differential case from the carrier. Ensure that the differential bearing shims are correctly positioned alongside the appropriate bearing caps and are not mixed. (Fig. 13).

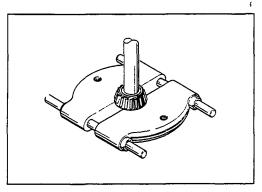


Figure 14

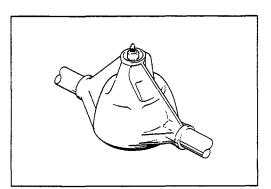


Figure 15

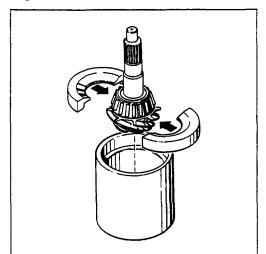


Figure 16

- If the differential bearing are to be replaced use the extractor shown in Fig. 14 to remove the old bearing and install the new bearing using a press and the installation tool.
- 4. Remove the bolts that attach the ring gear to the differential case. Press the ring gear from the case or tap it off with a soft face mallet.
- 5. Remove the companion flange.
- Press the pinion out of the front bearing cone and remove it through the rear of the carrier casting; a piece of soft metal or plastic should be used to protect the pinion threads. Do not hammer the pinion thread end.
- 7. Lever out the pinion oil seal and lift the front pinion bearing cone out of the carrier.
- 8. If the pinion bearing cups are to be replaced, drive them out of the carrier casting with a drift, taking care to tap alternately on opposite sides of the cap.

# NOTE: INSPECT THE HOUSING CUP SEATS AND REMOVE ANY BURRS WHICH MAY HAVE RESULTED FROM CUP REMOVAL.

Install the new cups with the tools as shown in Fig. 50. Ensure that the cups are properly seated in their bores. If a 0,04 mm feeler gauge can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not properly seated.

9. Remove the pinion rear bearing cone using the type of extractor shown in Fig. 16.

# INSPECTION AFTER REMOVAL AND DISASSEMBLY

Thoroughly clean all parts. Always use new solvent when cleaning bearings. If these bearings are to be re-used, oil them immediately to prevent rusting. Inspect the parts for nay major defect.

Clean the inside of the housing, paying special attention to the pinion oil gallery for cleanliness and freedom from restriction.

Inspect individual parts as outlined on page 20.

#### **GFARS**

#### Hypoid ring gear and pinion

The pattern taken during disassembly should help in judging if the gears can be reset by means of a shim or backlash correction. This should first be attempted before a gearset is discarded. Badly worn gears cannot be rebuilt to correct a noisy condition, although slightly worn gears can frequently be re-used with tolerable results.

Any gear scoring or scuffing caused by excessive shock loading or the use of an incorrect lubricant will render the gearset useless for further operation.

## Differential gears (Spider gears)

Examine the teeth and thrust surfaces of the differential gears. Wear on the hub of the differential gear or in the differential case can cause a noise known as "chuckle" when the car is driven at low speeds. Wear of the splines, thrust surfaces, or thrust washers can contribute to excessive drive line backlash. Differential gears do not however cause axle whine.

#### **BEARING CUPS**

Check bearing cups for nicks, spalling or uneven wear patterns. Pinion bearing cups must be solidly seated.

#### **CONE AND ROLLER ASSEMBLIES**

When operated in the cups, bearing rollers and cones must turn without roughness. Examine the roller ends for wear. Step-wear on the roller ends indicates excessive wear. Replace the bearing.

# DRIVE PINION FLANGE (Companion flange)

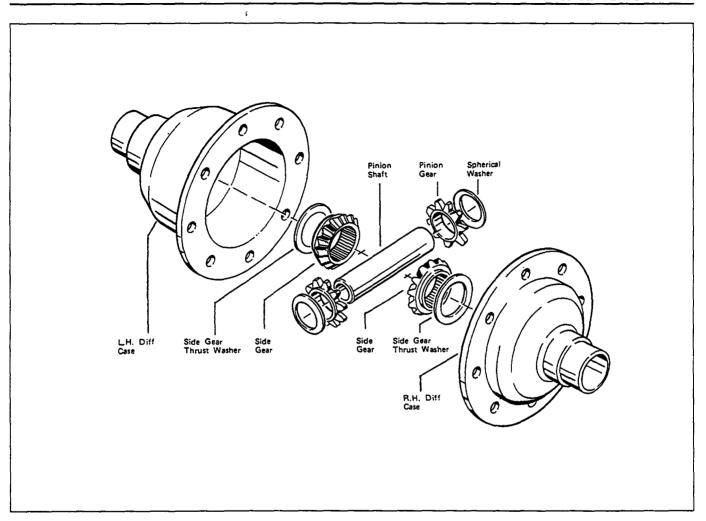
Be sure that the flange has not been damaged in the removing of the prop shaft or in removing the flange from the pinion. The end of the flange that contacts the bearing cone must be smooth. Replace if necessary.

#### **CARRIER CASTING**

Ensure that the bearing bores are smooth and the bearing abutment faces are not damaged. Remove burrs if necessary. Check the oil gallery for cleanliness.

#### **DIFFERENTIAL CASE**

Carefully examine the case hubs, which may have been damaged when the bearing were removed. The bearing assemblies will fall if they do not seat firmly on the hubs.



#### DISMANTLING

- 1. Unscrew the ring gear bolts and either press the ring gear off or use a soft mallet and tap if free from the case.
- 2. Drive out the differential pinion shaft retaining pin (spring pin).
- Drive out the differential pinion shaft (cross-shaft).
- 4. Insert a hard wood dowel, or a suitable soft metal drift, approximately 10 mm diameter by 300 mm long through the RH (long) side of the case resting on the differential side gear in the LH (shorter) side.

  Light hammer blows on alternate sides of the differential side gear will separate the case.
- 5. With the case separated, the differential side and pinion gears together with their respective thrust washers may be removed by hand.
- 6. Check all parts for excessive wear, particularly the fit of the side gears in the differential case.

  Check the side gear and pinion teeth for cracks and ensure that the thrust washers are in good condition.

## REASSEMBLE

- 1. Lubricate all gears and thrust washers with gear oil.
- 2. Replace the differential side gear together with its washer in the RH side of the differential case.
- Enter the undrilled end of the differential pinion shaft into the side of the differential case having the drilled hole for the differential shaft retaining pin.
- 4. Enter the shaft approximately 2 mm into the differential case, with the drilled hole correctly aligned (see Fig. 9 on page 7). Locate a pinion thrust shim and pinion gear on the shaft and hold it in position while tapping the shaft deeper into the case. Leave just enough of a gap to place the second pinion gear and washer in position. Care must be taken that as the pinion shaft is driven into position that the spherical washer is not damaged.
- 5. Ensure that the pinion shaft hole lines up with the drilled hole in the case and install the retaining pin.
- Place the outer side gear and thrust washer in the LH (short) side of the case and engaged the two halves of the case using the retaining pin as a guide.
- 7. Tap the two halves together using a soft mallet.
- Ensure that the differential case flanges are in good condition and enter two ring gear bolts in opposite holes on the assembled differential case and start threads into the ring gear. Enter the remaining ring gear bolts and tighten evenly.

Use a tightening sequence of "tighten one, miss two" and bring the ring gear bolts to the specified torque.



ANY BURRS OR DIRT ON THE MATING FLANGE FACES OR THE FLANGE FACE WHICH MATES WITH THE RING, CAN CAUSE RUN-OUT OR DISTORTION. FILE OFF BURRS AND CLEAN CAREFULLY BEFORE ASSEMBLY.

Insert R/H differential bearing cone on the appropriate press dolly and position the diff case under the press. Place the L/H bearing on the differential case hub and install the second press dolly and press the bearing home (Fig. 18).

#### NOTE:

CARE MUST BE TAKEN TO ENSURE THAT THE BEARING CONES ARE NOT SKEWED DURING THIS OPERATION, ENSURE THAT A 0,05 mm FEELER GAUGE WILL NOT ENTER BEHIND THE CONE AND THE DIFFERENTIAL BEARING SEAT.

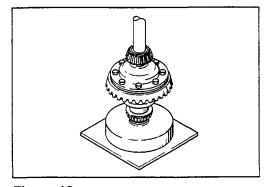


Figure 18

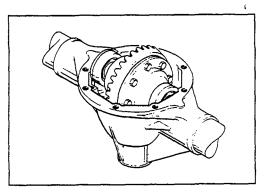


Figure 19

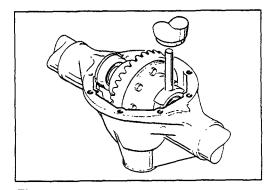


Figure 20

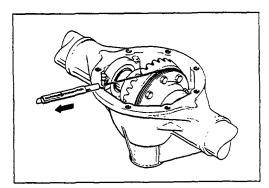


Figure 21

#### DIFF BEARING PRE-LOAD TORQUE SETTING

#### **METHOD**

Select any two differential bearing pre-load shims and place in against each of the differential bearing cups. Place the cups on the bearing cones and install the differential assembly in the carrier.

NOTE: THE SHIMS AND DIFFERENTIAL CUPS SHOULD ENTER THE CARRIER PARALLEL TO THE GEAR AS ANY SKEWING OF THE CUPS AND SHIMS MAY LEAD TO BRINELLING OF THE BEARINGS. (Fig. 19).

With the carrier spread, minimum effort is required to install the differential assembly into the carrier. If an overtight condition is noted, reduce the shims to facilitate easier assembly.

# UNDER NO CIRCUMSTANCES SHOULD THE CARRIER BE SPREAD MORE THAN 0.5 mm.

Do not hammer on the ring gear. (Fig. 20).

Release the spreader tool and note that the bearing cups are correctly positioned as they are not interchangeable.
\*Rotate the differential at least six times to seat the bearing

Measure diff bearing pre-load torque.

This can be measured in two ways:-

#### String and pull method

If the build procedure has been followed to this point, this method is suitable as the pinion has not been assembled, thus a 'rolling' torque can be measured.

- Wrap a length of string around the differential case adjacent to the gear back and tie the loose end to a spring scale.
- Pull the string with the scale so as to rotate the gear IN THE SAME DIRECTION as in \* above, slowly and steadily. (Fig. 21).
- 3. Read the spring scale reading while the gear is rotating steadily.
- Measure the diameter of the diff case around which the string was wrapped = D (mm).

Calculate the pre-load torque as follows:-

Pre-load Torque (Nm) =

Spring Scale Reading (kg) x Dia. D (mm)

200

Once the pre-load torque is correct, record the LH and RH shim thicknesses. The total of these two must remain the same even though the LH and RH shims may have to change individually to set the backlash.

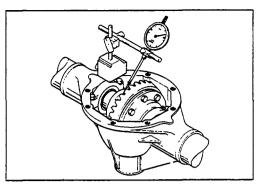


Figure 22

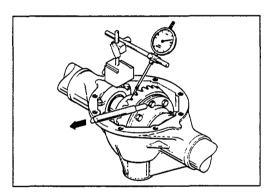


Figure 23

#### Break-away method

This method is used when the pinion is assembled in the carrier and must be executed as follows:-

- With the pinion, differential, shims and bearing cups assembled into the carrier, rotate the pinion in one direction so that the gear makes at least three complete revolutions to settle the bearings. Do not rotate the pinion or gear in the opposite directions at any stage during this procedure.
- Mount a dial indicator as if to measure ring gear backlash (i.e. probe on gear tooth), but do not measure backlash stage as this will 'unsettle' the bearings by turning them in the opposite direction. (Fig. 22).
- Attach a spring scale to one of the ring gear bolts and gently pull on the scale so as to rotate the ring gear in the same direction as that in which the bearings were settled in item 1. The spring scale must also pull in a tangential direction. (Fig. 23).
- 4. Whilst pulling the spring scale, observe the dial indicator needle. When the needle moves, it is indicating that the gear has started to rotate. When that happens, read the spring scale reading without pulling harder or softer on the scale.

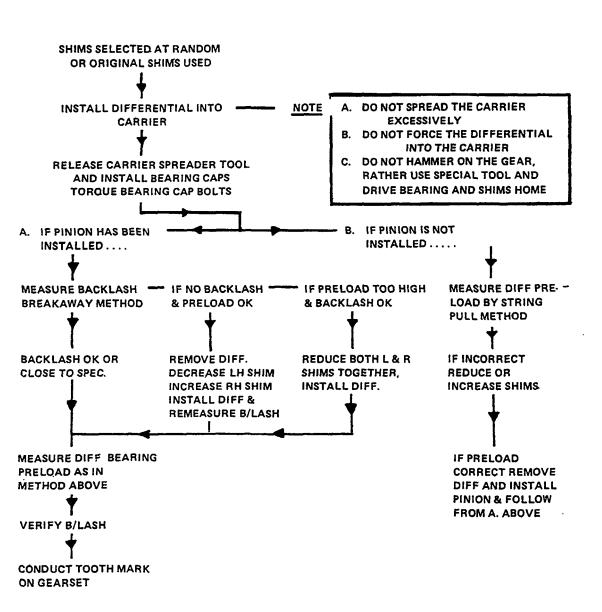
NOTE: OBSERVE THE SPRING SCALE READING AT THAT MOMENT WHEN THE GEAR MOVES THROUGH THE BACKLASH RANGE.

5. If you need to repeat the measurement, **do not** push the gear in the opposite direction, rather move the dial indicator probe out of the way, rotate the pinion as before in item 1, and then repeat the measurement as in item 2 to 4.

#### Diff preload torque specification:

	M75 M76 LM501349/10 Brgs.	M80
String pull method     Breakaway method     Backlash spec	0,8 to 1,5 Nm 1,0 to 2,0 kg 0,12 to 0,18 mm	1,5 to 2,0 Nm 2,0 to 3,0 kg 0,10 to 0,18 mm

As the diff bearing shim selection is a trail and error process, the following will be of assistance in determining the correct backlash and pre-load for the bearings:-



IRRESPECTIVE OF WHICH METHOD IS USED, IT IS VITALLY IMPORTANT THAT DIFF BEARING PRELOAD AND BACKLASH ARE TO SPECIFICATION ON COMPLETION OF ASSEMBLY. THIS WILL ENSURE OPTIMUM PERFORMANCE OF THE AXLE COMPONENTS. MEASUREMENTS SHOULD ALWAYS BE CONDUCTED WITH BEARING CAPS INSTALLED.

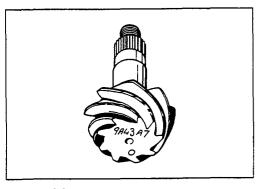
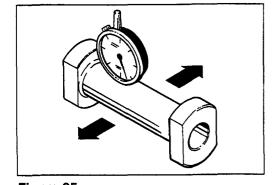


Figure 24



#### **REAR PINION SHIM SELECTION**

The operating positions of the gears require the use of an adjusting shim between either the pinion rear bearing cup and its seating surface in the carrier, or the rear bearing cone and the pinion head. When the shim thickness is decreased, the pinion is moved away from the drive gear. When the shim thickness is increased, the pinion is moved closer to the drive gear. This section describes the method of initial contact shim selection, but re-selection based on tooth contact pattern may be subsequently required. Typical drive pinion and ring gear markings are shown in (Fig. 24).

The number 9AA43A7 is the matched set number that appears on both the drive pinion and the ring gear. When a new gearset is being installed in an axle, be sure that the same number appears on both the pinion and the ring gear. A positive number on the drive pinion always indicates that a shim thinner than the normal shim for the particular model should be used to move the pinion away from the ring gear. A negative number means that a thicker shim should be used to move the pinion closer to the gear. This is known as the "Pinion Deviation".

Gearset deviations from nominal mounting distances are marked in thousandths of an inch - e.g. (+ 3 means + 0.003") and must be converted in accordance with the following table in which the figures are rounded to the nearest 0,005 mm.

#### Example:

 $-1 = -0.025 \, \text{mm} + 1 = + 0.025 \, \text{mm}$ 

-2 = -0,050 mm + 2 = + 0,050 mm

-3 = -0.075 mm + 3 = + 0.075 mm

The method of selecting the correct pinion shim starts with the nominal shim thickness (see pages 21) and makes adjustments according to the variations between actual and nominal dimensions of the components concerned. The dial gauge indicators are marked in 0,01 mm units, for the purposes of calculation; the 0,005 mm readings should be estimated as minor inaccuracies and will have little effect on the end result.

#### **GAUGING OF THE CARRIER**

- Roll the depth gauge cylinder on a flat surface and adjust the dial to zero at its highest point. (Fig. 25).
   A work bench is not an accurate flat surface, therefore at least a piece of ground gauge plate should be used.
- Ensure that the rear pinion bore in the carrier is clean and free from all burrs, particularly around the knockout slots.
- Place the dummy pinion in the rear pinion bearing bore, ensuring that it rests properly against the abutment face without any rocking and that it is not wedged against the sides of the bore.

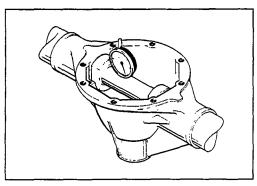


Figure 26

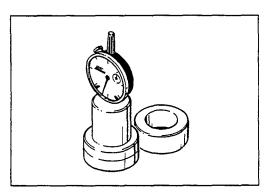


Figure 27

4. Place the depth gauge cylinder in the differential bearing bores and rock it backwards and forwards, noting the highest reading on the dial gauge. (Fig. 26).

This is the 'carrier deviation'. A plus reading (+) indicates that the bearing seat is closer than nominal to the differential and the pinion shim thickness must be reduced accordingly, and vice-versa.

#### GAUGING THE REAR PINION BEARING

- Clean both sides of the setting master ring and place it on a flat surface.
- Clean the annular face of the bearing gauge and position it in the setting ring. Rotate the gauge to and fro to ensure that it is seated correctly and zero the gauge dial.
- 3. Ensure that the bearing is free from dirt, heavy oil or thick grease. DO NOT REMOVE the protective lubricant on new Timken bearings as this is used to set pre-load torque values on the bearings. If the bearing has been used or is contaminated, wash the bearing in a suitable cleaning solvent, and oil the bearing with a suitable hypoid oil and allow to drain.
- 4. Place the bearing on a flat surface with the back of the cone down and the cup on top.
- 5. Place the bearing gauge in the bearing with the ring of the gauge against the back face of the cup.
- 6. Rotate the gauge a few revolutions, in one direction only, while applying medium to heavy hand pressure in order to seat the rollers correctly and to drive out surplus lubricant from between the bearing surfaces. Record the dial gauge reading. This reading is known as the 'bearing deviation'. (Fig. 27).

CAUTION: SINCE THE GAUGES WORK IN OPPOSITE SENSES, DO NOT CONFUSE THE RULES FOR SHIM ADJUSTMENT FOR CARRIER VARIATIONS WITH THOSE FOR BEARING VARIATIONS.

#### NOMINAL REAR PINION SHIM TICKNESSES AND POSITIONS:

As the shim position can vary in different models, the following table will assist in quick reference.

AXLE MODEL	RING GEAR OUTER	RATIOS	SHIM POSITION	NOMINAL THICKNESS
M75	191 mm and 197 mm	2,92 3,23 3,50* 3,70 3,89 4,00* 5,14*	On Pinion under Cone or against Carrier behind Cup*	2,299 mm or 0,483 mm
M80	203 mm	4,875 5,14*	Against Carrier Behind rear Pinion Bearing Cup	0,483 mm

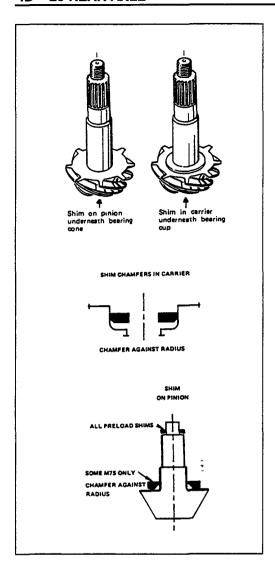
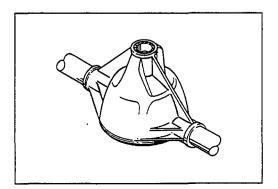


Figure 28



Care should be taken during disassembly to note whether the pinion has a raised bearing seat (shim seats behind bearing cup) or no seat (shim to be installed behind pinion head between bearing cone). (Fig. 28).

To calculate the thickness, refer to both the carrier and bearing deviation as shown in the example below:

M75 axle		mm
Carrier deviation		-0,125
Bearing deviation		-0,050
Pinion deviation		0
Nominal shim thickness		2,30
Carrier deviation -0,125	i.e. <b>less</b> material	
	therefore add	0,125
Bearing deviation -0,050	i.e. <b>more</b> material	
	therefore reduce	-0,050
Pinion deviation is 0	there shim	
	thickness required	2,325

# DRIVE PINION ASSEMBLY AND INSTALLATION: MODEL 75/80

- Install the selected shim with pinion rear and front bearing cups in the carrier using the bearing cups in the carrier using the bearing cup installing tool. The contact shim is a thin shim of a nominal size of 0,48 mm and is installed behind the cup. In some older units the shim may be be located behind the pinion head, under the rear pinion bearing cone. Here the chamfer must be installed against the pinion head. (see Fig. 28).
- 2. Press the rear bearing cone onto the pinion.

NOTE: IF NEW TIMKEN BEARINGS ARE BEING INSTALLED, DO NOT CLEAN AND OIL THE BEARINGS. INSTALL THE BEARINGS AS RECEIVED. THESE BEARINGS ARE SUPPLIED WIT A LUBRICANT CALLED FERROCOTE WHICH IS THE SPECIFIED LUBRICANT FOR PRE-LOAD TORQUE MEASUREMENT. HOWEVER, SHOULD THE BEARING APPEAR VERY DRY OR CONTAMINATED, WASH IN A SUITABLE SOLVENT AND APPLY A RECOMMENDED HYPOID OIL. IN THIS CASE PRE-LOAD TORQUE SHOULD BE 0,8 - 1,5 Nm.

- Place the pinion front bearing cone in the cup in the carrier.
- Install the pinion oil seal in the carrier casting. The outer face of the seal should be flush with carrier face. (Fig. 29).

- Position the original (or mid range) pre-load shim on the drive pinion with the chamfered side towards the shoulder.
- 6. Install the companion flange into the seal and hold firmly against the front pinion bearing cone.
- Enter the pinion from the back of the carrier and into the companion flange. If necessary, support pinion head and tap the flange with a soft mallet to start it on the pinion splines and start the pinion nut on the threads.
- 8. Holding the flange, tighten the pinion nut. As the pinion nut is tighten, the pinion shaft is pulled onto the front bearing cone and onto the flange. As soon as there is pre-load on the bearing, rotate the pinion several turns in one direction only, to seat the bearing rollers.

IMPORTANT: DO NOT APPLY FULL NUT TORQUE AT THIS STAGE. CHECK THE PRE-LOAD WHILE THE PINION NUT IS BEING TIGHTENED; IF THERE IS ANY SUSPICION THAT THE PRE-LOAD WILL BE GROSSLY IN EXCESS OF THE SPECIFIED FIGURE, REMOVE THE PINION SHAFT AND FIT A THICKER PRE-LOAD SHIM SINCE OVER-TIGHTENING THE BEARINGS CAN CAUSE PREMATURE FAILURE. TIGHTEN THE PINION NUT TO THE SPECIFIED TORQUE. (REFER 9 BELOW).

# NOTE: PINION SHAFT SHOULD BE PRESSED OUT AS HAMMERING WILL DAMAGE PINION BEARINGS.

 Measure the pre-load. With the nose of the carrier up, take readings at a smooth and steady speed through a few revolutions in one direction only. Correct torque readings and any binding conditions (usually caused by dirt or faulty bearing).

# PINION BEARING PRE-LOAD TORQUE SPECIFICATION

Model 75, 76

1,0 - 2,0 Nm (new bearings)

Model 80

1,5 - 2,5 Nm (new bearings)

0,8 - 1,5 Nm (used/oiled bearings)

Pinion Nut Torque: 320 - 370 Nm for solid Pre-load Shim For Collapsible Shim, refer item 10.

REMEMBER: TO INCREASE PRE-LOAD, USE A THICKER PRE-LOAD SHIM.

TO DECREASE PRE-LOAD, USE A THICKER PRE-LOAD SHIM.

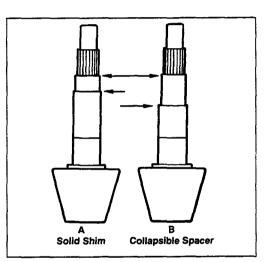


Figure 30

 Should the gearset model incorporate a collapsible preload shim, tighten the pinion nut gradually, checking the pre-load at intervals until the correct pre-load torque is obtained.

IMPORTANT: UNDER NO CIRCUMSTANCES MAY THESE SHIMS BE RE-USED. IF THE PRE-LOAD TORQUE IS EXCEEDED DURING TIGHTENING, REMOVE THE PINION, REPLACE THE COLLAPSIBLE SHIM AND REPEAT THE PROCEDURE.

#### **COLLAPSIBLE PINION PRE-LOAD SPACER**

 Install the pinion oil seal in the carrier housing. The outer face of the oil seal should be flush with carrier face.

CAUTION: IF THE PINION IS THE TYPE WHICH USES A COLLAPSIBLE SPACER TO OBTAIN PINION BEARING PRE-LOAD, IT IS ESSENTIAL THAT THE OIL SEAL BE INSTALLED AT THIS POINT, AS THE PINION NUT MAY NOT BE LOOSENED IN ORDER TO INSTALL THE OIL SEAL AFTER FINAL ASSEMBLY.

- (a) Install the pre-load spacer on the pinion.

  NOTE: TWO TYPES OF PINION PRE-LOAD SHIMS ARE
  USED IN GEARMAX AXLES:
- (a) SOLID SHIM
- (b) COLLAPSIBLE SPACER

The chart listed below indicates the introduction model part number for the various model axles. The model part number appears on the I.D. TAG as a prefix to the serial number.

(b) AXLES WITH MODEL PART NUMBERS INDICATED IN THE CHART AND HIGHER WILL HAVE COLLAPSIBLE SPACER TYPE GEARSETS.

The lettering on the collapsible spacer model I.D. tags will be RED while all solid shim models will continue with the BLACK lettering currently used.

AXLE MODEL	PART NUMBER
AXLE TYPE	FROM THIS NO. AND HIGHER
M68	FROM PREFIX 171 - COLLAPSIBLE
M70	FROM PREFIX 150 - COLLAPSIBLE
M71	FROM PREFIX 050 - COLLAPSIBLE
M75	FROM PREFIX 250 - COLLAPSIBLE
M76	FROM PREFIX 034 - COLLAPSIBLE

SERIAL No. , 85 BC 4006 AA oM71 RATIO 4.110 PREFIX \_\_\_\_\_\_ 053 \_ 01001

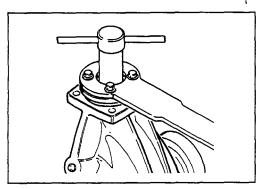


Figure 31

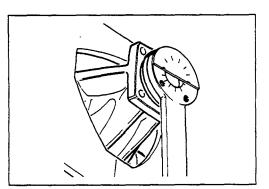


Figure 32

- 2. Install the companion flange into the seal and hold firmly against the front pinion bearing cone.
- 3. Enter the pinion from the back of the carrier and into the flange. Use the tool as illustrated to draw the pinion spline into the companion flange, sufficiently for the pinion nut to start on the threads. (see Fig. 31).

NOTE: ONLY THE ONE PIECE COLLAR NUT MAY BE USED WITH THE COLLAPSIBLE SPACER.

Holding the companion flange, tighten the pinion nut.
 As the pinion nut is tightened, the front pinion bearing cone and companion flange are pulled onto the pinion shaft.

# SETTING PINION BEARING PRE-LOAD WITH THE COLLAPSIBLE SPACER:

WARNING: STRICT RULES APPLY FOR PRE-LOAD SETTING USING COLLAPSIBLE SPACERS. THESE ARE:-

- (a) If the pinion pre-load is set too high, the pinion nut may not be backed off to correct the pre-load torque. The pinion must be disassembled, DISCARD the collapsible spacer and repeat the assembly sequence.
- (b) Only the one piece pinion nut may be used.
- (c) An accurate torque wrench (1-5 Nm) must be used to measure pinion pre-load torque, and should be a dial type readout, not the clicker type.
- (d) A dial indicator, stand and clamp are needed to mea sure pinion bearing end float during the pre-load setting sequence.
- (e) Cut out the protractor on page and park the companion flange retaining spanner in 10 degree steps as shown in Fig. 32.

#### 5. METHOD:

- (a) Tighten the pinion nut checking frequently for end float, until a small amount of end float remains.
- (b) Measure the end float by attaching a dial indicator to the carrier and while rotating the flange back and forth through approximately 45 degrees, lift upwards. (ref. Fig. 5).
- (c) Zero the dial indicator while maintaining the upward force on the pinion, then repeat the process while pressing down on the flange, and note the reading.
- (d) Reduce the end float to between 0,20 mm and 0,05 mm by further tightening the pinion nut.
- Refer to the chart below (step 7) and check the measured end float against the ranges of end float listed in column A.

Column B indicates the number of degrees of nut rotation for a given amount of float.

PINION END FLOAT vs NUT ROTATION FOR PRE-LOAD SETTING:

A END FLOAT	B NUT ROTATION
0.20 - 0.18 mm	70 - 66 degrees
0.17 - 0.15 mm	64 - 59 degrees
0.14 - 0.12 mm	57 - 52 degrees
0.11 - 0.09 mm	50 - 45 degrees
0.08 - 0.06 mm	43 - 37 degrees
0.05 - 0.03 mm	36 - 32 degrees
0.02 - 0.00 mm	30 - 25 degrees
	1

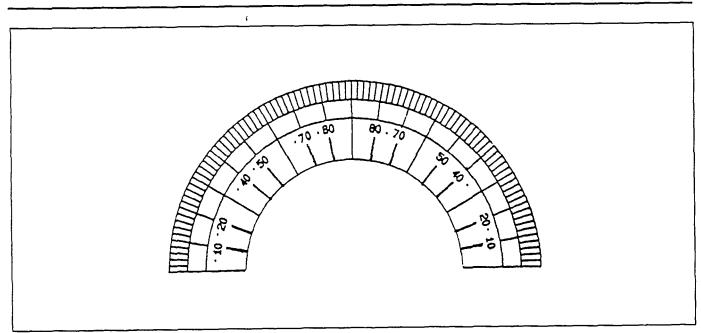
 Tighten the pinion nut the required amount as indicated in the above chart. Measure the pre-load torque using a suitable torque wrench.

		_
Pinion pre-load torque spec	1,7 - 2,5	
for collapsible spacer	Nm	

 Should the pre-load torque be less than the specified torque, tighten the nut a further 5 degrees and re-check the pre-load torque.

#### 10. REMEMBER:

IF THE TOOTH CONTACT REQUIRES CHANGING THE CONTACT SHIM, THE PINION PRE-LOAD SPACER MUST BE REPLACED AND THE ABOVE PROCEDURE REPEATED.



- 1. Make a photostat copy of the protractor above.
- Cut the protractor out and attach it to the flange retaining spanner as shown on page 25 Fig. 32 of the Service Manual.
- Mark the inner circumference of the flange in 10 degrees steps from 10 degrees to 360 degrees. (ie. the full circle).
- 4. Once the 10 degree steps have been transferred to the flange, they should be checked and then permanently set using a sharp chisel.

#### SUMMARY OF REBUILD OPERATION

- Select differential bearing shims as per string pull method described on page 23.
   When the diff pre-load is correct, remove the diff assembly from the carrier.
- 2. Select the pinion contact shim (refer page 27) and assemble the pinion into the carrier as described (refer page 29).
  When the pinion pre-load torque is correct, install the differential assembly into the carrier.
  Using the breakaway method on page 24, measure the backlash and diff pre-load. Should it be necessary to change backlash, the total sum of the R/H and L/H shims should remain constant (i.e. if the L/H shim is reduced by 0.05 mm then increase the R/H shim by 0.05 mm).
- Conduct a tooth contact marking inspection (refer page 15) and refer to the chart on page 17 and 18.
   Re-select the contact shim if necessary, based on the guidelines of the chart on page 15.

#### NOTE:

- (a) Correct tooth contact is the final acceptance of a correct build and contact shim selection.
- (b) When changing the contact shim the pre-load shim requires the same amount of change as it moves in sympathy with the contact shim, pinion pre-load torque is to be re-checked each time.
- (c) It is recommended that new bearings are used in all overhaul cases. The only time used bearings may be utilised is when the mileage covered is below 1 000 km.

#### A GOOD BUILD HAS CORRECT:

- TOOTH CONTACT PATTERN
- PINION BEARING PRE-LOAD TORQUE
- BACKLASH
- DIFF BEARING PRE-LOAD TORQUE



#### GEAR MARKING COMPOUND

This is available from Borg-Warner outlets in tins as shown in Fig. 33.

This compound is ready for use and should be applied sparingly for best results.

It is recommended that 2/3 of the gear be covered to ensure that accurate reading of the tooth contact is possible.

# ISUZU<br/>KB - SERIES

# **WORKSHOP MANUAL**

**SECTION 4C** 

FRONT WHEEL DRIVE

# SECTION 4C FRONT WHEEL DRIVE

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# MAIN DATA AND SPECIFICATIONS

#### FRONT AXLE AND DIFFERENTIAL

Ring gear size mm(in)		197 (7,75)
Axle tube		
Туре		It consists of the duce, a cast iron housing and the axle tube.
Gear type		Hypoid
Gear ratio 4ZE1 engine 4JA1 engine 4JB1T engine	(to 1)	4.777 4.777 4.555
Differential type		Two pinion
oil capacity	litre (US/UK gal)	1.0 (0.26/0.22)
Axle shaft type		Constant velocity joint (Birfield joint type and double offset joint).
Hub locking type		Automatic locking and Manual locking free wheel hubs.

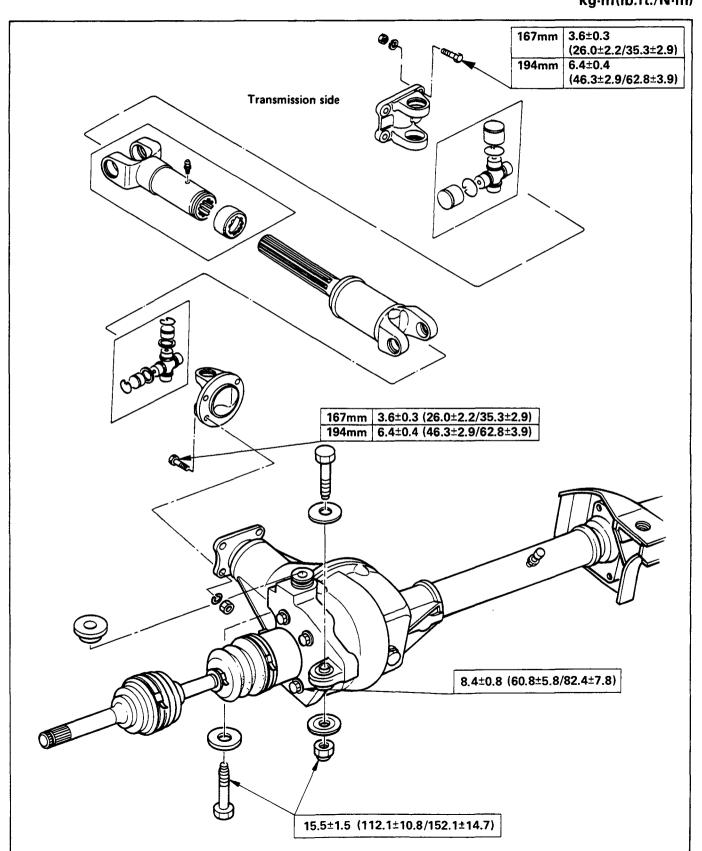
## FRONT PROPELLER SHAFT

Transmission type		MSG	MUA
Outside diameter	mm(in)	32 (1.26)	40 (1.57)
Inside diameter	mm(in)	_	36.5 (1.44)
Length (between two spiders centre)	mm(in)	407 (16.02)	517 (20.35)

## SPECIAL PARTS FIXING NUTS AND BOLTS

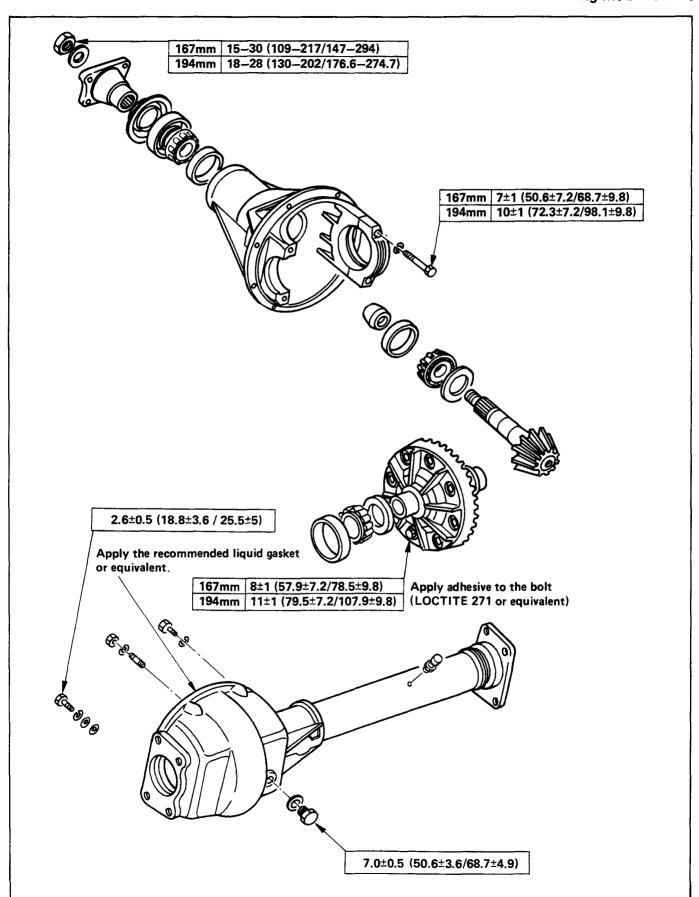
FRONT DRIVE AXLE AND PROPELLER SHAFT

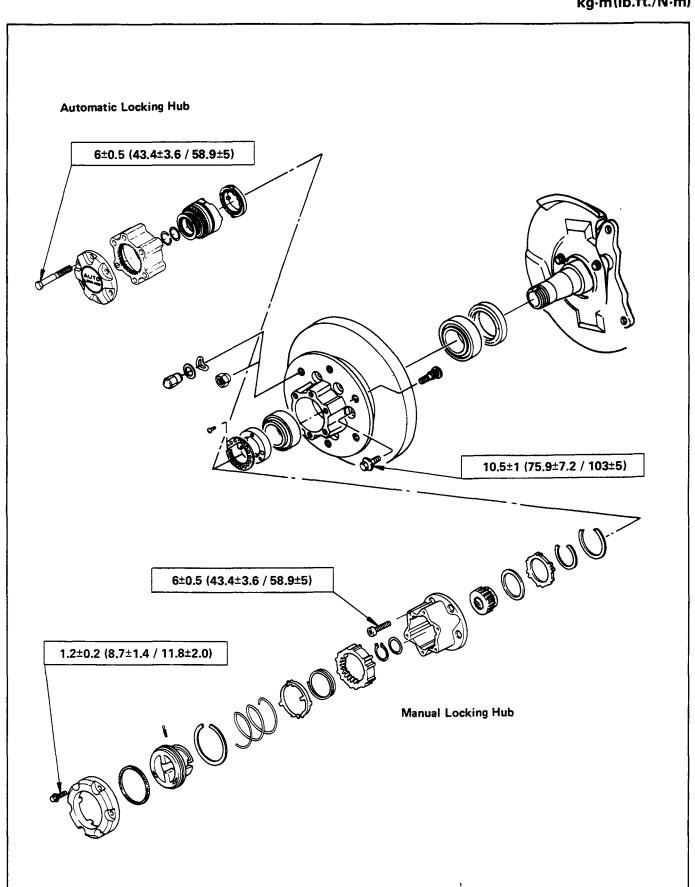
kg·m(lb.ft./N·m)



#### FRONT DIFFERENTIAL

kg·m(lb.ft./N·m)







# RECOMMENDED LIQUID GASKET

Туре	Brand Name	Manufacturer	Remarks
RTV*	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	For Engine Repairs
Silicon Base	ThreeBond 1215	Three Bond	For Axle Case Repairs, T/M
Water Base	ThreeBond 1141E	Three Bond	For Engine Repairs
Solvent	Solvent  ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402		For Engine Repairs
Anerobic LOCTITE 515 LOCTITE 518		Loctite Loctite	All

<sup>\*</sup> RTV: Room Temperature Vulcanizer

#### Note:

- 1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
- 2. Be careful to use the specified amount of liquid gasket. Follow the manufacturer's instructions at all times.
- 3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.

The connecting surfaces must be perfectly dry.

4. LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.

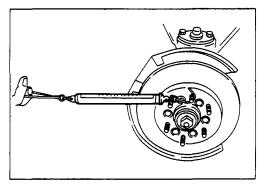
Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.



# RECOMMENDED THREAD LOCKING AGENTS

LOCTITE Type	LOCTITE Color	Application Steps
LOCTITE 242	Blue	Completely remove all lubricant and moisture from the bolts and the female threaded surfaces of the parts to be joined.  The surfaces must be perfectly dry.
		2. Apply LOCTITE to the bolts.
LOCTITE 262	Red	Apply LOCTITE to at least 1/3 of the bolt's threaded area
LOCTITE 270	Green	
		3. Tighten the bolts to the specified torque.
LOCTITE 271	Red	Wait at least one hour before continuing the installation procedure.

## **SERVICING**





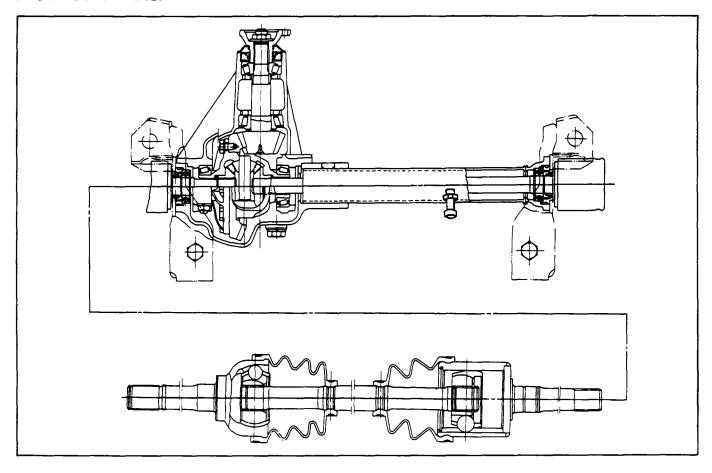
## **Hub Bearing Preload at the Wheel Pin**

4 x 4 Model	kg(lb)		
New bearing and New oil seal	2 -2.5 (4.4-5.5)		
Reuse bearing and New oil seal	1.2-1.8 (2.6-4.0)		

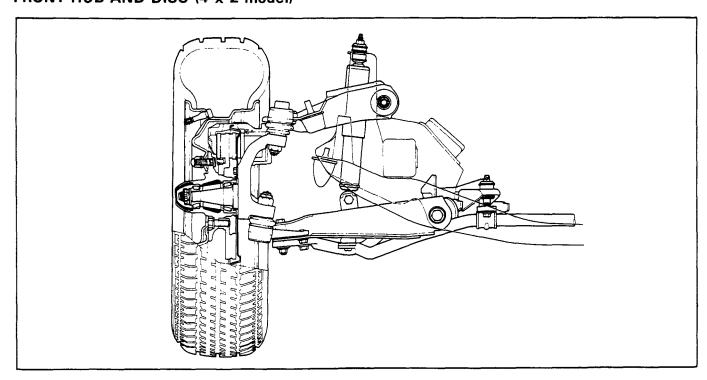
4 x 2 Model	kg(lb)	
New bearing and New oil seal	0.8-1.0 (1.8-2.2)	
Reuse bearing and New oil seal	0.8-1.0 (1.8-2.2)	

# **GENERAL DESCRIPTION**

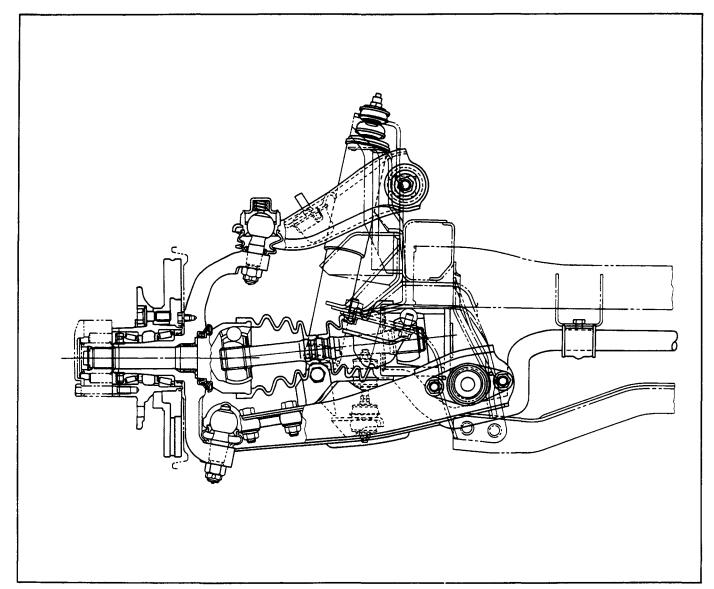
## FRONT DRIVE AXLE



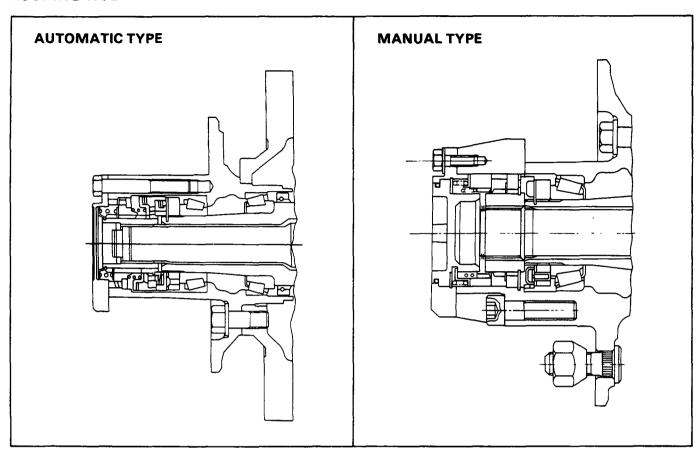
## FRONT HUB AND DISC (4 x 2 model)



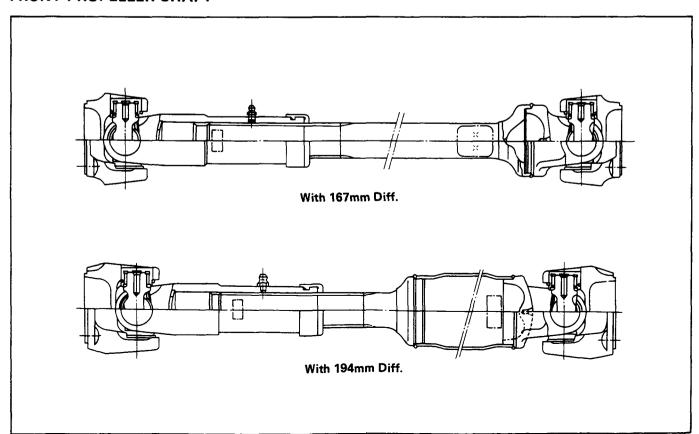
## FRONT HUB AND DISC (4 x 4 model)



## **LOCKING HUB**



## FRONT PROPELLER SHAFT

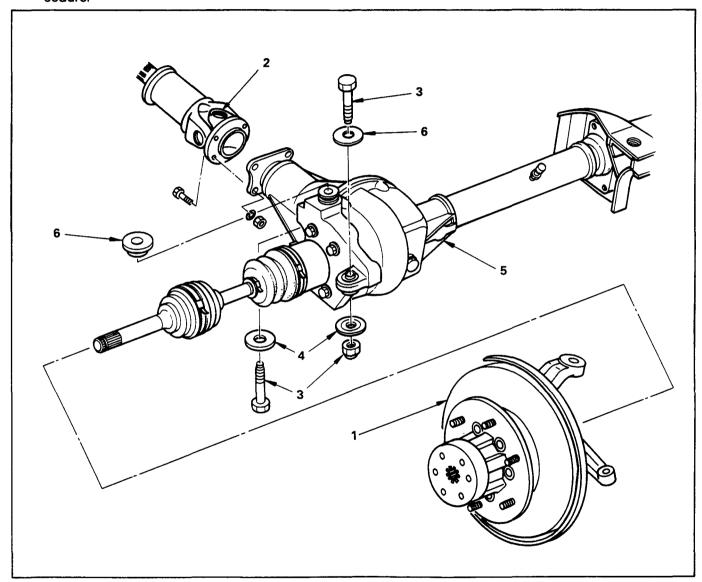


## FRONT DRIVE AXLE ASSEMBLY



# **REMOVAL AND INSTALLATION**

- 1. Refer to SECTION 3E "WHEEL AND TIRES" for road wheel Disassembly and Reassembly procedure.
- 2. Refer to SECTION 5 "BRAKES" for disc brake caliper removal and installation procedure.
- 3. Refer to SECTION 3B "STEERING" for Steering linkage removal and installation procedure.
- 4. Refer to SECTION 4C "FRONT WHEEL DRIVE" for Automatic hub disassembly and reassembly procedure.

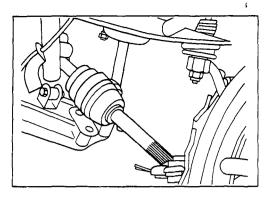


#### **Removal Steps**

- ▲ 1. Assembly of hub and disc, back plate, knuckle, knuckle arm, and lower end.
- 2. Propeller shaft
  - 3. Nut and bolt
  - 4. Washer
- 5. Front drive axle assembly
  - 6. Washer

#### Installation Steps

- 6. Washer
- ▲ 5. Front drive axle assembly
  - 4. Washer
- 3. Nut and bolt
- ▲ 2. Propeller shaft
  - Assembly of hub and disc, back plate, knuckle, knuckle arm, and lower end.

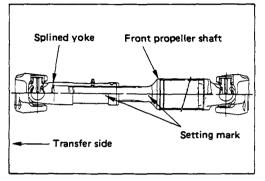




#### Important Operations - Removal

1. Assembly of hub and disc, back plate, knuckle, knuckle arm, and lower end.

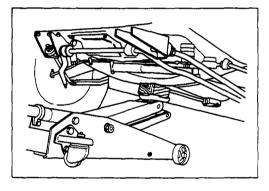
Before removal, jack up the front of vehicle and support the frame with jack stands.



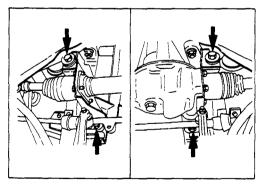


#### 2. Propeller Shaft

Apply the setting marks.



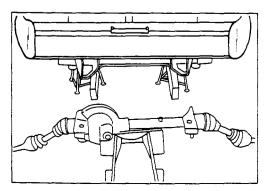
- 5. Front Drive Axle Assembly
- (1) Put the lifting jack under the center part of the front.



(2) Remove four bolts fixing axle case mounting brackets to the frame.

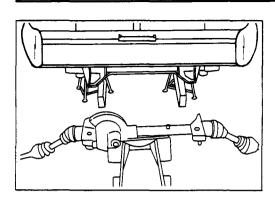
#### Note:

Be careful not to damage birfield joints or double off-set joints when supporting axle shaft assembly.



(3) Lower the front axle assembly and roll it out toward the front of the vehicle.

Take care not to damage the birfield joints or the double off-set joints.





## Important Operations — Installation

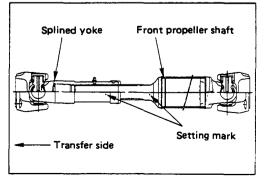
## 5. Front Drive Axle Assembly

Place the front axle assembly in position under the vehicle using a lifting jack.



#### 3. Nut

J. Hut	
Front Axle Mounting Nut Torque	kg·m(lb.ft./N·m
15.5 ± 1.5 (112.1 ± 10.8/152.1	± 14.7)





#### 2. Propeller Shaft

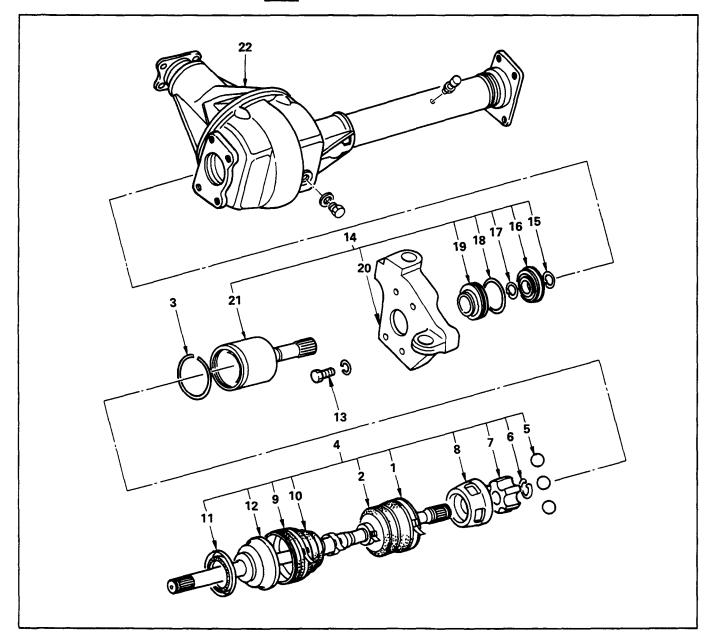
Align the setting marks applied the removal.



Bolt Torque		kg·m(lb.ft/N·m)		
167 mm	$3.6 \pm 0.3 (26.0 \pm$	$\pm$ 2.2/35.3 $\pm$ 2.9)		
104	64 + 04/460	+ 20/620 + 20		

194 mm	6.4	± 0.4	(46.3 ±	2.9/62.8	± 3.9

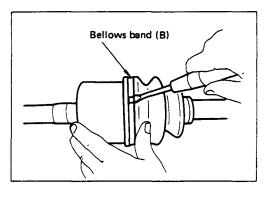
# DISASSEMBLY



## **Disassembly Steps**

- ▲ 1. Band
  - 2. Bellows
- ▲ 3. Circlip
  - 4. BJ shaft assembly
- ▲ 5. Ball
- ▲ 6. Snap ring
  - 7. Ball retainer
  - 8. Ball guide
- ▲ 9. Band
  - 10. Bellows
  - 11. Dust seal

- 12. BJ shaft
- 13. Bolt
- 14. DOJ case assembly
- 15. Snap ring
- 16. Bearing
- 17. Snap ring
- 18. O-ring
- 19. Oil seal
- 20. Bracket
- 21. DOJ case
- 22. Axle case and differential

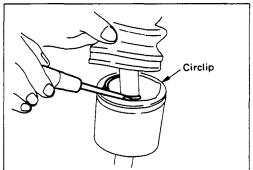




# **Important Operations**

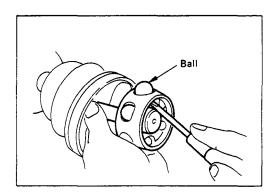
#### 1. Band

Raise the hooked end of the band with a screwdriver or equivalent.



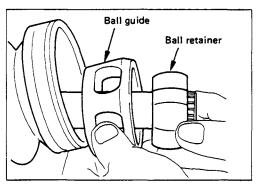
# 3. Circlip

Pry off with a screwdriver or equivalent.



#### 5. Ball

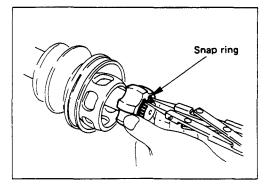
Remove the six balls with a screwdriver or equivalent.



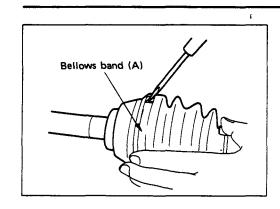
Rotate the case half a pitch to align the ball guide on the case with the projected portion of the ball retainer, then slide the case toward the bellows. The case can not be removed in the reverse direction.

# 6. Snap Ring

Remove the snap ring fastening the ball retainer to the center shaft.



# FRONT WHEEL DRIVE 4C-17



#### 9. Band

Raise the hooked end of the band with a screw driver or equivalent.



# INSPECTION AND REPAIR

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

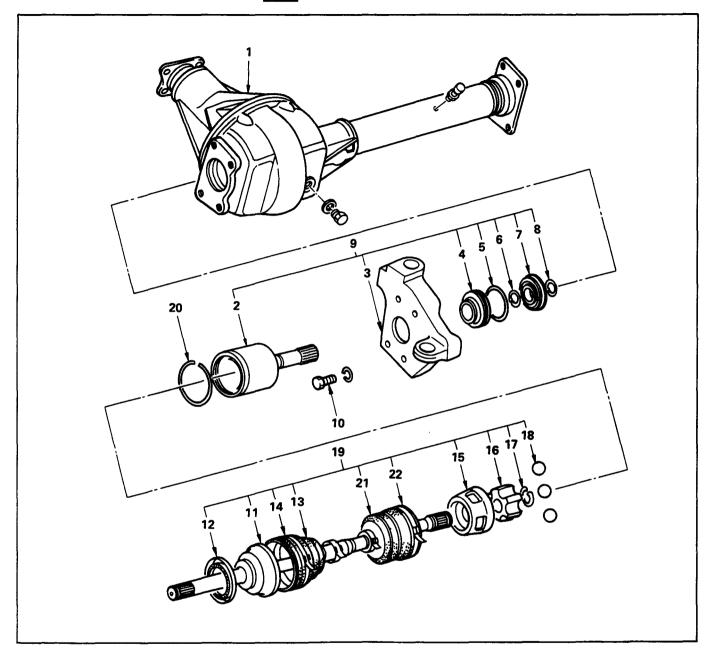
- BJ assembly
- DOJ case, ball, ball guide ball retainer
- Bellows
- Bearing
- Dust seal, oil seal



# Visual Check

Inspect the following parts for wear, damage, or other abnormal conditions.

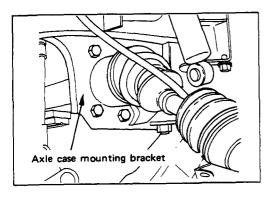
# REASSEMBLY



# **Reassembly Steps**

- 1. Axle case and differential
- 2. DOJ case
- 3. Bracket
- 4. Oil seal
- 5. O-ring
- 6. Snap ring
- 7. Bearing
- 8. Snap ring
- 9. DOJ case assembly
- ▲ 10. Bolt
  - 11. BJ shaft

- 12. Dust seal
- ▲ 13. Bellows
- ▲ 14. Band
- ▲ 15. Ball guide
- ▲ 16. Ball retainer
- ▲ 17. Snap ring
- ▲ 18. Ball
- ▲ 19. BJ shaft assembly
- ▲ 20. Circlip
- ▲21. Bellows
- ▲ 22. Band





# Important operations

10. Bolt

kg·m(lb.ft./N·m)

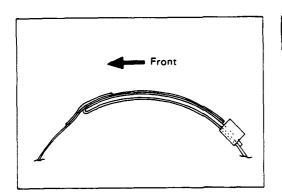
8.4 ±0.8 (60.8 ±5.8/82.4 ±7.8)



# 13. Bellows

**Bolt Torque** 

- (1) Apply a thin coat of grease to the shaft for smooth installation
- (2) Apply specified grease to the 1/2 space of the bellows.

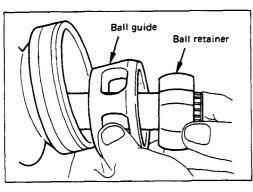




#### 14. Band

Note the setting direction.

After installation, check that the bellows is free from distortion.

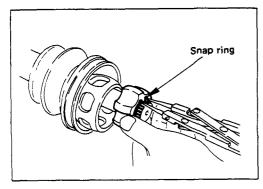




# 15. Ball Guide

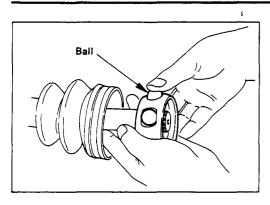
#### 16. Ball Retainer

Install the ball guide with the smaller diameter side ahead onto the shaft.



# 17. Snap Ring

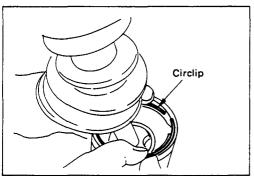
Install the snap ring securing the ball retainer to the shaft.





#### 18. Ball

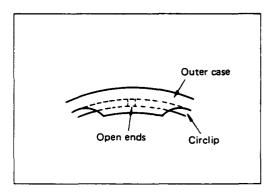
Bring the ball guide of the cage into alignment with the projected porton of the ring on the ball retainer, then turn the cage 1/2 pitch. Align the track on the ball retainer with the window in the cage and install the six balls into position.





# 19. BJ Shaft Assembly

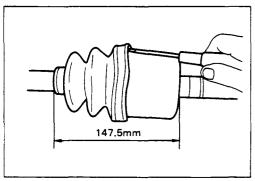
Apply specified grease to the half of the space of the DOJ case (Approx. 50g (1.8 oz))





# 20. Circlip

Install the circlip so that open ends are positioned away from the ball groove.





#### 21. Bellows

(1) Before installation, insert the appropriate amount of specified grease into the DOJ case.



(2) Adjust the air pressure within the bellows by inserting a screwdriver or equivalent, so that it equals atmospheric pressure.

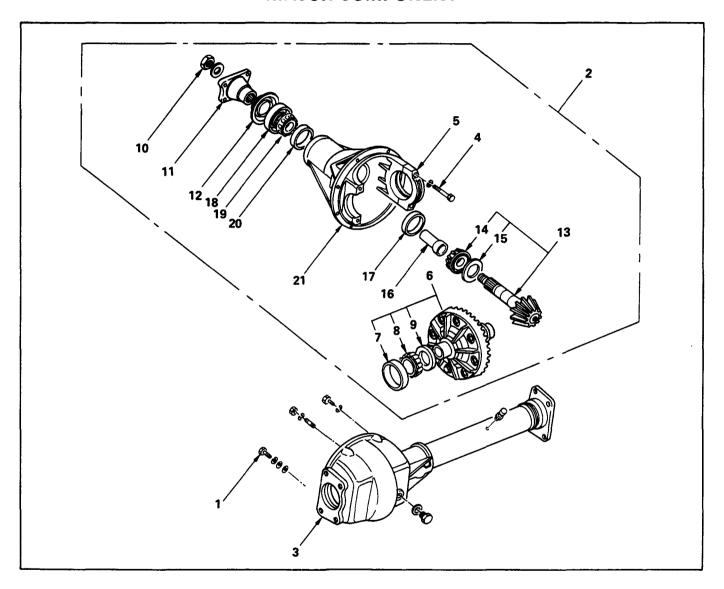
#### 22. Band

After installation, check that the bellows is free from distortion.

# **DIFFERENTIAL**



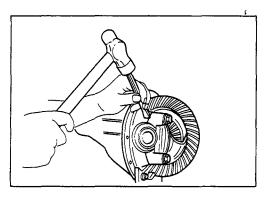
# **MAJOR COMPONENT**



# **Disassembly Steps**

- Bolt
- 2. Differential assembly
- 3. Axle case
- 4. Bolt
- ▲ 5. Bearing cap
  - 6. Diff. cage assembly
- ▲ 7. Side bearing outer race
- ▲ 8. Side bearing
- ▲ 9. Adjust shims
- ▲ 10. Flange nut
  - 11. Flange

- 12. Dust cover
- ▲ 13. Pinion gear
- ▲ 14. Inner bearing
  - 15. Adjust shim
  - 16. Collapsible spacer
- ▲ 17. Inner bearing outer race
  - 18. Oil seal
  - 19. Outer bearing
- ▲ 20. Outer bearing outer race
  - 21. Diff. carrier

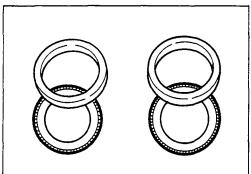




# **Important Operations**

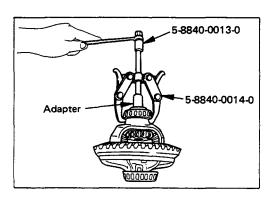
# 5. Bearing Cap

Apply a setting mark to the side bearing cap and the differential carrier.



# 7. Side Bearing Outer Race

After removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.





# 8. Side Bearing

Remover: 5-8840-0013-0

(J-22888)

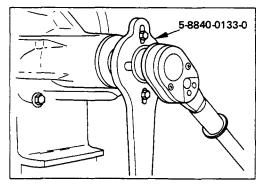
5-8840-0014-0

(J-22888-30)

Adapter : 5-8521-0019-0 (167 mm)

9-8521-1743-0 (194 mm)

(J-8107-2)





## 9. Adjust Shims

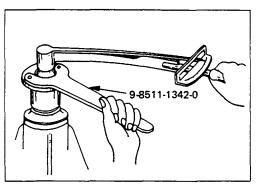
Note the thickness and position of the shims removed.

## 10. Flange Nut

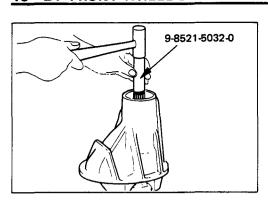
Holding wrench: 5-8840-0133-0 (167 mm and 194 mm)

(J-8614-01)

or 9-8511-1342-0 (Only for 167 mm)



# 4C-24 FRONT WHEEL DRIVE

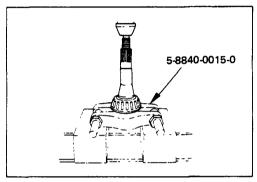




# 13. Pinion Gear

Remove the drive pinion assembly using a soft metal rod and a hammer.

Spindle: 9-8521-5032-0

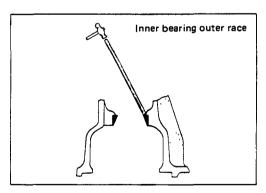




# 14. Inner Bearing

Remove the inner bearing using a separator and a press.

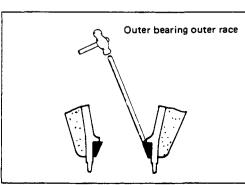
Separator : 5-8840-0015-0 (J-22912-01)



# 17. Inner Bearing Outer Race

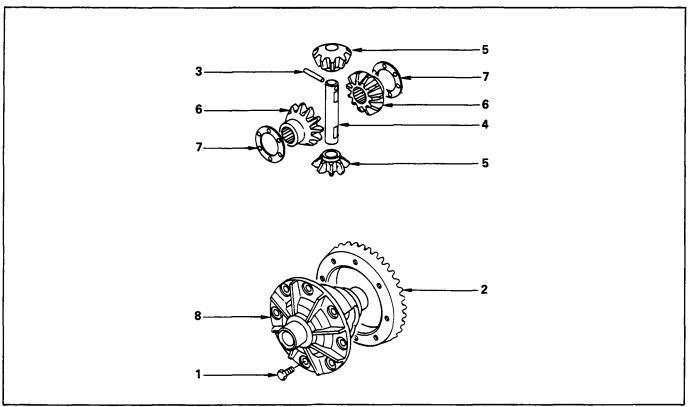
# 20. Outer Bearing Outer Race

Remove the inner bearing outer race and the outer bearing outer race by using a brass bar and a hammer.





# MINOR COMPONENTS

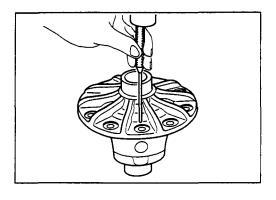


# **Disassembly Steps**

- 1. Bolt
- Ring gear
   Lock pin
- ▲ 4. Cross pin

- 5. Pinion gear
- 6. Side gear
- 7. Thrust washer
- 8. Differential cage

# 4C-26 FRONT WHEEL DRIVE

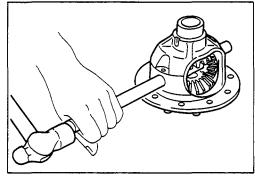




# **Important Operations**

#### 3. Lock Pin

Break staking on the lock pin using a 5 mm (0.20 in.) diameter drill.



#### 4. Cross Pin

Remove the cross pin using a soft metal rod and a hammer.



# **INSPECTION AND REPAIR**

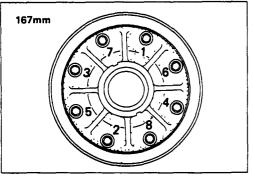
Make all necessary adjustment, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

- Ring gear, pinion gear
- Bearing
- Side gear, pinion gear, cross pin
- Differential cage, carrier
- Thrust washer
- Oil seal



#### Visual Check

Inspect the following parts for wear, damage, or other abnormal conditions.

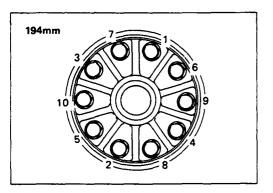




#### **Ring Gear Replacement**

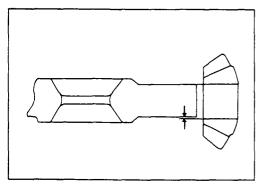
- The ring gear should always be replaced with the drive pinion as a set.
- (2) When installing the ring gear, apply LOCTITE 271 or equivalent to the threaded hole and bolt.
- (3) Tighten the fixing bolts in a diagonal sequence as illustrated.
- (4) Discard used bolts and install new ones.

Bolt Torque		kg·m(lb.ft/N·m)
167 mm	8 ± 1 (57.9 ± 7.2/	$78.5 \pm 9.8$ )
194 mm	$11 \pm 1 (79.6 \pm 7.2/1)$	$07.9 \pm 9.8$



# For 167 mm

Note that all bolts have a left hand thread.

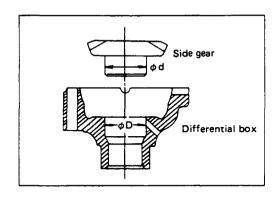




# Clearance Between the Differential Pinion and the Cross Pin

		mm(in)
	Standard	Limit
167mm	0.06-0.12 (0.002-0.005)	0.2 (0.008)
194mm	0.05-0.10 (0.002-0.004)	0.2 (0.008)

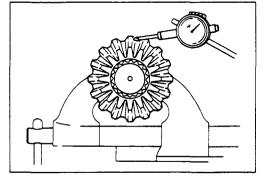
#### 4C-28 FRONT WHEEL DRIVE





# Clearance Between the Side Gear and the Differential Box

		<u> </u>
	Standard	Limit
167mm	0.03-0.11 (0.001-0.004)	0.15 (0.006)
194mm	0.03-0.10 (0.001-0.004)	0.15 (0.006)



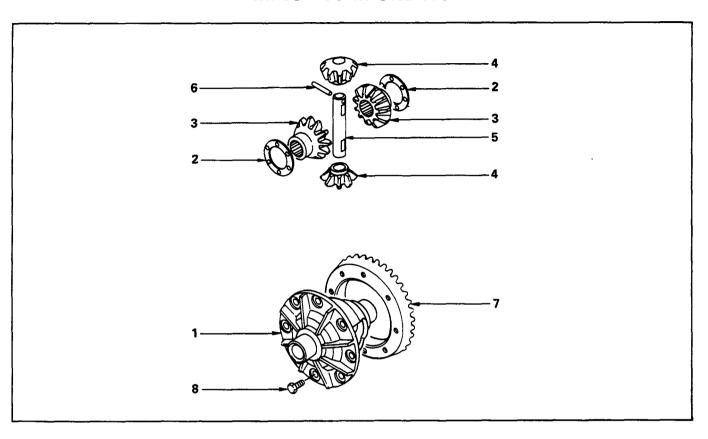


# Play in Splines Between the Side Gear and the Axle Shaft

		mm(in
	Standard	Limit
167mm	0.11-0.38 (0.004-0.015)	0.30 (0.012)
194mm	0.07-0.36 (0.003-0.014)	0.25 (0.010)



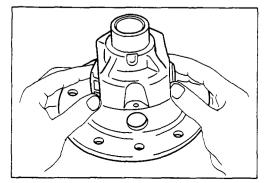
# MINOR COMPONENTS



# **Reassembly Steps**

- 1. Differential cage
- 2. Thrust washer
- 3. Side gear
- ▲ 4. Pinion gear

- ▲ 5. Cross pin
- ▲ 6. Lock pin
- ▲ 7. Ring gear
- ▲ 8. Bolt



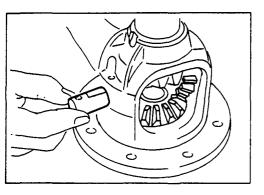


# **Important Operations**

#### 4. Pinion Gear

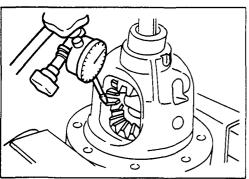
Install the pinion gear by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.

## 4C-30 FRONT WHEEL DRIVE



# 5. Cross Pin

(1) Be sure to install the cross pin so that it is in alignment with the lock pin hole in the differential cage.



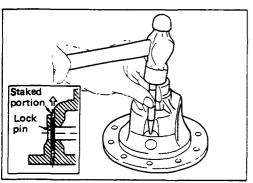


(2) Adjust the backlash between the side gear and the pinion gear.

Backlash	0.03 - 0.08 (0.001 - 0.003)

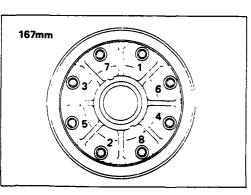
Thickness of thrust washers available

	mm(in
167 mm	1.05, 1.15, 1.25 (0.041, 0.043, 0.049)
194 mm	1.00, 1.05, 1.10 (0.039, 0.041, 0.043)



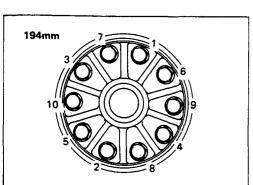
# 6. Lock Pin

After lock pin installation, stake the cage to prevent discharge of the lock pin.



## 7. Ring Gear

When installing the ring gear, apply LOCTITE 271 or equivalent to the threaded hole and bolt.





# 8. Bolt

Tighten the bolts in diagonal sequence as illustrated.

Bolt Torque	kg·m(lb.ft/N·m)
167 mm	$8 \pm 1 (57.9 \pm 7.2 / 78.5 \pm 9.8)$
194 mm	$11 \pm 1 \ (79.6 \pm 7.2/107.9 \pm 9.8)$



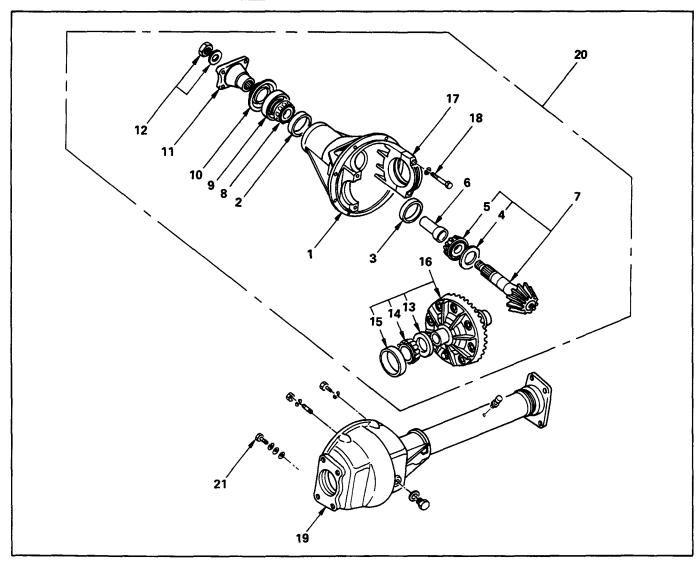
# Note:

Discard used bolts and install new ones.

For 167 mm



# **MAJOR COMPONENT**

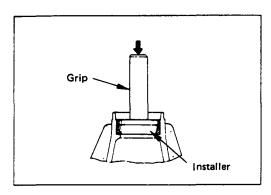


# **Reassembly Steps**

- 1. Diff. carrier
- ▲ 2. Outer bearing outer race
- ▲ 3. Inner bearing outer race
- ▲ 4. Adjust shim
- ▲ 5. Inner bearing
- ▲ 6. Collapsible spacer
  - 7. Pinion gear
  - 8. Outer bearing
- ▲ 9. Oil seal
  - 10. Dust cover

- 11. Flange
- ▲ 12. Flange nut and washer
- ▲ 13. Adjust shim
- ▲ 14. Side bearing
  - 15. Bearing outer race
  - 16. Diff. cage assembly
- ▲ 17. Bearing cap
- ▲ 18. Bolt
  - 19. Axle case
- ▲ 20. Differential assembly
  - 21. Bolt

# 4C-32 FRONT WHEEL DRIVE





# **Important Operations**

2. Outer Bearing Outer Race

Installer: 5-8522-0048-0 (167 mm)

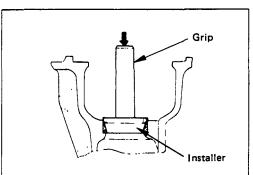
(J-29038)

9-8522-1141-0 (194 mm)

(J-24256)

Grip: 5-8840-0007-0

(J-8092)





# 3. Inner Bearing Outer Race

Installer: 5-8522-0049-0 (167 mm)

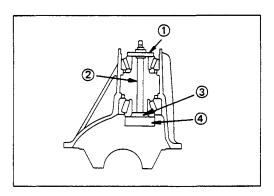
(J-29039)

9-8522-1274-0 (194 mm)

(J-24252)

Grip : 5-8840-0007-0

(J-8092)





# 4. Adjust Shim

Adjustment of drive pinion mounting distance

(1) Apply gear oil to the inner and outer drive pinion bearing.

Clean the pinion setting gage set.

Then install the gage set together with the inner and

outer bearings.



## For 167 mm

1 Pilot

: 5-8840-2092-0 (J-23597-28)

2 Nut and bolt : 5-8840-0127-0

(J-21777-43)

3 Rear pilot : 5-8840-2091-0

(J-23597**-**27)

(4) Gage plate : 5-8840-2090-0 (J-23597-26)

#### For 194 mm

1) Pilot

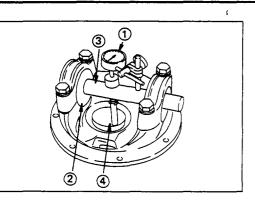
: 5-8840-2085-0

(J-21777-42)

Nut and bolt : 5-8840-2089-0 (J-23597-9)

4 Gage plate : 5-8840-2087-0

(J-23597-7)





Tighten the nut to the specified torque.

	kg·cm(lb.in/N·m)
New bearing	23 (20/2.26)
Used bearing	10 — 12 (8.7 — 10.4/0.98 — 1.18)



(2) Clean the side bearing bores. Install the dial indicator with the discs and Arbor. Install and tighten the bearing caps to the specified torque.



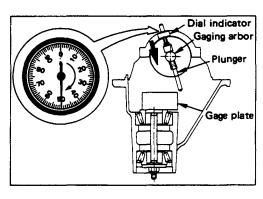
Torque		kg·m(lb.ft/N·m)
167 mm	$7.0 \pm 1.0 (50.6 \pm$	$7.2/68.7 \pm 9.8$
194 mm	$10.0 \pm 1.0 (72.3 \pm$	$7.2/98.1 \pm 9.8$ )

# For 167 mm

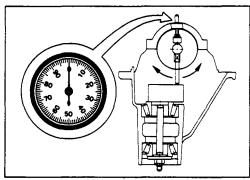
- ① Dial indicator : 5-8840-0126-0 (J-8001)
- Disc (2 pcs.) : 5-8840-2086-0 (J-23597-4)
- 3 Arbor : 5-8840-0128-0 (J-23597-1)
- Gage plate : 5-8840-2090-0 (J-23597-26)

# For 194 mm

- ① Dial indicator : 5-8840-0126-0 (J-8001)
- Disc (2 pcs.) : 5-8840-2088-0 (J-23597-8)
- ③ Arbor : 5-8840-0128-0 (J-23597-1)
- (4) Gage plate : 5-8840-2087-0 (J-23597-7)

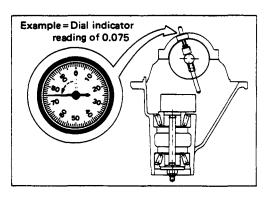


(3) Set the dial indicator to "O". Place it on the mounting post of the gaging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.



(4) Position the plunger on the gage plate. Move the gaging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest deflection. At this point, once again set the dial indicator to "O".

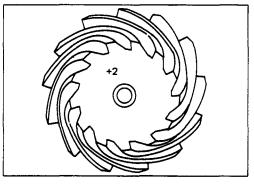
Repeat the procedure to verify the "0" setting.





(5) After the ZERO setting is obtained, rotate the gaging arbor until the dial indicator rod does not touch the gaging plate.
Page 1 the purple of the dial indicator road to point to

Record the number the dial indicator needle points to.





(6) Record the pinion depth code on the head of the drive pinion.

The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code "0", the pinion is "nominal".

# (6) Select the shim using the chart;

# For 167 mm

mm(in)

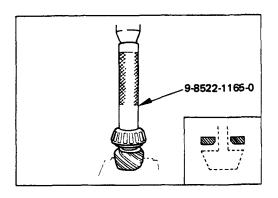
101 107 11111							111111111111111111111111111111111111111
Pinion marking  Dial indicator reading (Inches)	+6	+4	+2	o	-2	-4	6
0.052	·			<u> </u>			1.39(0.0547)
0.053						1.39(0.0547)	1.41(0.0555)
0.054					1.39(0.0547)	1.41 (0.0555)	1.43(0.0563)
0.055				1.39(0.0547)	1.41(0.0555)	1.43(0.0563)	1.45(0.0571)
0.056		1.39(0.0547)	1.41 (0.0555)	1.43(0.0563)	1.45(0.0571)	1.47(0.0579)	1.49(0.0587)
0.057	1.39(0.0547)	1.41(0.0555)	1.43(0.0563)	1.45(0.0571)	1.47(0.0579)	1.49(0.0587)	1.51 (0.0594)
0.058	1.41(0.0555)	1.43(0.0563)	1.45(0.0571)	1.47(0.0579)	1.49(0.0587)	1.51 (0.0594)	1.53(0.0602)
0.059	1.43(0.0563)	1.45(0.0571)	1.47(0.0579)	1.49(0.0587)	1.51(0.0594)	1.53(0.0602)	1.55(0.0610)
0.060	1.47(0.0579)	1.49(0.0587)	1.51 (0.0594)	1.53(0.0602)	1.55(0.0610)	1.57(0.0618)	1.59(0.0626)
0.061	1.49(0.0587)	1.51(0.0594)	1.53(0.0602)	1.55(0.0610)	1.57(0.0618)	1.59(0.0626)	1.61 (0.0634)
0.062	1.51(0.0594)	1.53(0.0602)	1.55(0.0610)	1.57(0.0618)	1.59(0.0626)	1.61 (0.0634)	1.63(0.0642)
0.063	1.55(0.0610)	1.57(0.0618)	1.59(0.0626)	1.61(0.0634)	1.63(0.0642)	1.65(0.0650)	1.67(0.0657)
0.064	1.57(0.0618)	1.59(0.0626)	1.61 (0.0634)	1.63(0.0642)	1.65(0.0650)	1.67(0.0657)	1.69(0.0665)
0.065	1.59(0.0626)	1.61 (0.0634)	1.63(0.0642)	1.65(0.0650)	1.67(0.0657)	1.69(0.0665)	1.71 (0.0673)
0.066	1.61(0.0634)	1.63(0.0642)	1.65(0.0650)	1.67(0.0657)	1.69(0.0665)	1.71 (0.0673)	1.73(0.0681)
0.067	1.65(0.0650)	1.67(0.0657)	1.69(0.0665)	1.71 (0.0673)	1.73(0.0681)	1.75(0.0689)	1.77(0.0697)
0.068	1.67(0.0657)	1.69(0.0665)	1.71 (0.0673)	1.73(0.0681)	1.75(0.0689)	1.77(0.0697)	
0.069	1.69(0.0665)	1.71(0.0673)	1.73(0.0681)	1.75(0.0689)	1.77(0.0697)		
0.070	1.71(0.0673)	1.73(0.0681)	1.75(0.0689)	1.77(0.0697)			
0.071	1.75(0.0689)	1.77(0.0697)		]			
0.072	1.77(0.0697)	_		]			

For 194 mm

mm(in)

Pinion marking Dial indicator reading (Inches)	+10	+8	+6	+4	+2	o	-2	-4	-6	-8	-10
0.081							1	1		1	2.18(0.0858)
0.082							ļ			2.18(0.0858)	2.20(0.0866)
0.083			i						2.18(0.0858)	2.20(0.0866)	2.24(0.0882)
0 084							1	2 18(0 0858)	2.20(0.0866)	2.24(0.0882)	2.26(0.0890)
0.085		,	Į .		ļ		2.18(0.0858)	2.20(0.0866)	2.24(0.0882)	2.26(0 0890)	2.28(0.0898)
0.086						2.18(0.0858)	2.20(0.0866)	2.24(0.0882)	2.26(0.0890)	2.28(0.0898)	2.32(0.0914)
0.087			ļ		2 18(0.0858)	2.20(0.0866)	2.24(0.0882)	2.26(0.0890)	2.28(0.0898)	2.32(0.0914)	2.34(0.0921)
0.088		•		2.18(0.0858)	2.20(0.0866)	2.24(0.0882)	2.26(0.0890)	2.28(0.0898)	2.32(0.0914)	2.34(0.0921)	2.36(0.0929)
0 089			2.18(0.0858)	2.20(0.0866)	2 24(0.0882)	2.26(0.0890)	2.28(0.0898)	2.32(0.0914)	2.34(0.0921)	2.36(0.0929)	2.38(0.0937)
0.090		2.18(0.0858)	2.20(0 0866)	2.24(0.0882)	2.26(0.0890)	2 28(0.0898)	2.32(0.0914)	2.34(0.0921)	2.36(0.0929)	2.38(0.0937)	2 42(0.0953)
0.091	2.18(0.0858)	2 20(0.0866)	2 24(0.0882)	2.26(0 0890)	2.28(0.0898)	2 32(0.0914)	2.34(0.0921)	2.36(0.0929)	2.38(0.0937)	2.42(0.0953)	2.44(0 0961)
0.092	2 20(0.0866)	2.24(0 0882)	2.26(0.0890)	2.28(0 0898)	2.32(0.0914)	2.34(0.0921)	2.36(0.0929)	2.38(0.0937)	2.42(0.0953)	2,44(0.0961)	2.46(0.0969)
0 093	2.24(0 0882)	2.26(0 0890)	2.28(0.0898)	2.32(0 0914)	2.34(0.0921)	2.36(0 0929)	2.38(0.0937)	2 42(0.0953)	2.44(0.0961)	2.46(0.0969)	2.48(0.0977)
0.094	2.26(0.0890)	2 28(0.0898)	2.32(0 0914)	2.34(0 0921)	2.36(0.0929)	2.38(0.0937)	2.42(0.0953)	2.44(0.0961)	2.46(0.0969)	2.48(0.0977)	2.52(0.0992)
0 095	2.28(0.0898)	2.32(0.0914)	2.34(0.0921)	2.36(0.0929)	2.38(0.0937)	2 42(0.0953)	2 44(0.0961)	2 46(0.0969)	2.48(0.0977)	2.52(0.0992)	2.54(0.1000)
0 096	2.32(0.0914)	2.34(0.0921)	2.36(0.0929)	2.38(0.0937)	2.42(0 0953)	2 44(0 0961)	2.46(0.0969)	2.48(0.0977)	2.52(0.0992)	2,54(0.1000)	2.56(0.1008)
0 097	2.34(0.0921)	2 36(0.0929)	2 38(0.0937)	2.42(0.0953)	2.44(0 0961)	2 46(0.0969)	2.48(0.0977)	2.52(0.0992)	2.54(0.1000)	2.56(0.1008)	
0.098	2.36(0.0929)	2 38(0.0937)	2 42(0.0953)	2 44(0.0961)	2 46(0.0969)	2 48(0.0977)	2.52(0 0992)	2.54(0.1000)	2.56(0.1008)		
0 099	2.38(0 0937)	2.42(0 0953)	2.44(0.0961)	2 46(0.0969)	2 48(0.0977)	2.52(0.0992)	2.54(0 1000)	2 56(0.1008)			
0	2 42(0.0953)	2.44(0.0961)	2.46(0.0969)	2.48(0.0977)	2.52(0.0992)	2.54(0 1000)	2.56(0.1008)				Í
0 001	2 44(0.0961)	2.46(0.0969)	2 48(0 0977)	2.52(0.0992)	2.54(0 1000)	2.56(0.1008)	Ì				
0 002	2 46(0.0969)	2 48(0.0977)	2.52(0 0992)	2 54(0 1000)	2.56(0 1008)		ì				l
0.003	2.48(0.0977)	2.52(0.0992)	2 54(0 1000)	2 56(0.1008)	}	l	1				1
0 004	2.52(0.0992)	2 54(0 1000)	2.56(0.1008)				}				
0.005	2.54(0.1000)	2.56(0 1008)					1				
0.006	2.56(0.1008)										

Note: When ordering shims, find the part number in the parts catalog by using the thickness of shims listed in the above table.





# 5. Inner Bearing

Place the shim on the drive pinion, with the chamfered side turned towards the pinion head then install the inner bearing on to the pinion using an installer and a press.

Installer: 9-8522-1165-0 (J-6133-01)



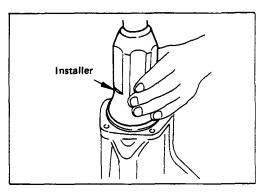
#### Note:

Do not apply pressure to the roller cage. Apply pressure only to the inner race.



# 6. Collapsible Spacer

Discard the used collapsible spacer and install, a new one.





#### 9. Oil Seal

Use oil seal installer to install a new oil seal that has been soaked in rear axle lubricant.

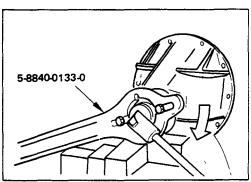


Installer: 5-8522-0046-0 (J-26234) (For 167 mm)

9-8522-1275-0 (J-24250) (For 194 mm)

# Note:

Take care not to use a rear differential oil seal instead of the front differential oil seal.





# 12. Flange Nut and Washer

#### For 194 mm



- (1) Apply lubricant to the pinion threads.
- (2) Tighten the nut to the specified torque using the pinion flange holder.

Pinion flange holder: 5-8840-0133-0 (J-8614-01)



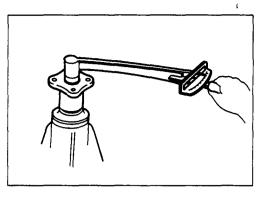
Torque

kg·m(lb.ft/N·m)

18 - 28 (130 - 202/176.6 - 274.7)



Discard used flange nut and install new one.



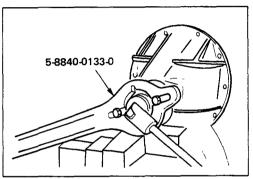


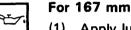
- (a) Measure the bearing preload by using a torque meter. Note the scale reading required to rotate the flange.
- (b) Continue tightening until the specified starting torque



is obtained.	
Starting Torque	kg-cm(lb.in/N-m)

6.5 - 11.5 (5.7 - 9.9/0.63 - 1.13)





(1) Apply lubricant to the pinion threads.

(2) Tighten the nut to the specified torque using the pinion flange holder.

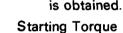
Pinion flange holder: 5-8840-0133-0 (J-8614-01)

kg·m(lb.ft/N·m) Torque 12 - 13 (87 - 94/117 - 127)



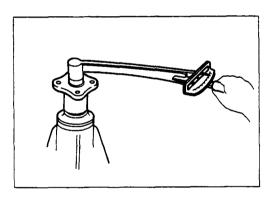
Discard used flange nut and install new one.

(3) Continue tightening until the specified starting torque is obtained.



kg.cm(lb.in/N·m)

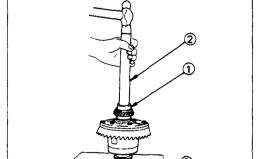
6 - 11 (5.2 - 9.5/0.59 - 1.0)





# 13. Adjust Shim

(1) Attach the side bearing to the differential assembly without shims. Support the opposite side using a pilot to prevent bearing damage.





**1**) Installer : 5-8840-0138-0

(J-29036)

Drive handle : 5-8840-0007-0

(J-8092)

Pilot : 5-8521-0019-0

#### For 194 mm

: 9-8521-1164-0 Installer

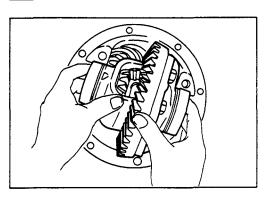
(J-24244)

Drive handle : 5-8840-0007-0

(J-8092)

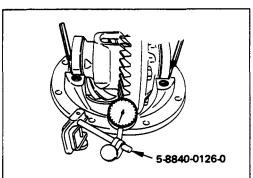
Pilot : 9-8521-1743-0

(J-8107-2)





(2) Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.



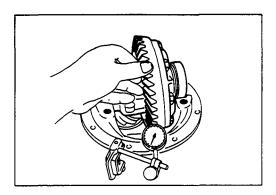


Using two sets of feeler gauges, insert a feeler stock (3) of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

Mount the dial indicator on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.

Dial indicator: 5-8840-0126-0

(J-8001)



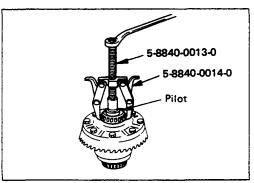


Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

Backlash mm(in)

0.13 - 0.18 (0.005 - 0.007)

With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.05 mm (0.002 in) to each shim pack to provide side bearing preload. Always use new shims.





Remove side bearing (5)

Remover: 5-8840-0013-0

(J-22888)

5-8840-0014-0

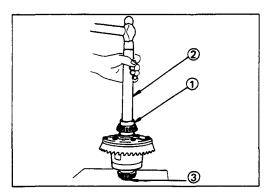
(J-22888-30)

Pilot

: 5-8521-0019-0 (167 mm)

9-8521-1743-0 (194 mm)

(J-8107-2)





# 14. Side Bearing

Install the side bearings together with the selected shims.

#### For 167 mm

(1) Installer : 5-8840-0138-0 (J-29036)

Drive handle : 5-8840-0007-0 (J-8092)

: 5-8521-0019-0

# **Pilot** For 194 mm

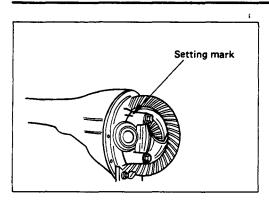
Installer

: 9-8521-1164-0 (J-24244)

Drive handle : 5-8840-0007-0 (J-8092)

Pilot

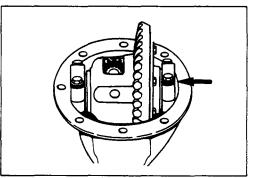
: 9-8521-1743-0 (J-8107-2)





# 17. Bearing Cap

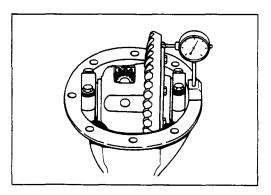
Align the setting marks applied at disassembly.





#### 18. **Bolt**

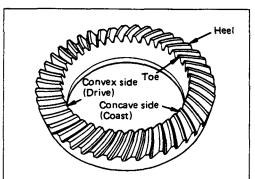
<b>Bolt Torque</b>	kg·m(lb.ft/N·m
167 mm	$7 \pm 1 (50.6 \pm 7.2/68.7 \pm 9.8)$
194 mm	$10 \pm 1 \ (72.3 \pm 7.2/98.1 \pm 9.8)$





Measure the amount of run-out of the ring gear at its rear face.

mm(in		
Limit		
0.05 (0.002)		

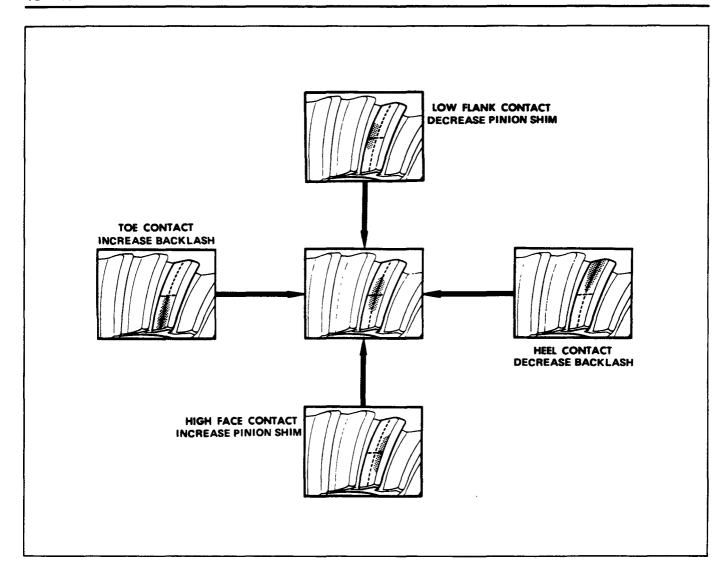


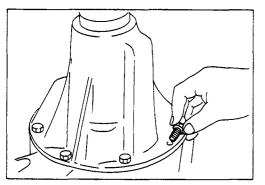


# **Gear Tooth Contact Pattern Check and Adjustment**



Apply a thin coat of prussian blue or equivalent to the faces of the 7-8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described below if the contact is abnormal.







#### 20. Differential Assembly

(1) Clean the faces of the front axle case and differential carrier.

Apply the recommended liquid gasket or its equivalent to the sealing side of the axle case and the carrier.



(2) Attach the differential case and the carrier assembly to the front axle case and tighten the nuts and bolts. The axle case bolt is used for drainage.

Torque		kg·m(lb.ft/N·m)
	$2.6 \pm 0.5 (18.8 \pm 3.6/25.5)$	± 5)

(3) Install the axle shaft assemblies as instructed earlier in this section under "Axle Shaft Replacement".



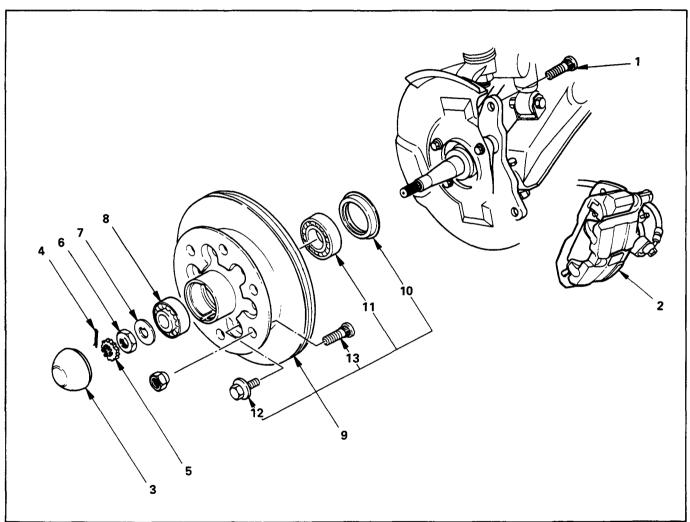
(4) Fill the axle case with hypoid gear lubricant, to just below the filler hole.

Lubricant capacity	liter (US/UK gal)		
167 mm	1.0 (0.26/0.22)		
194 mm	1.4 (0.37/0.31)		

# FRONT HUB AND DISC (4 x 2 model)



Refer to SECTION 3E "WHEEL AND TIRE" for wheel removal procedure.



# **Disassembly Steps**

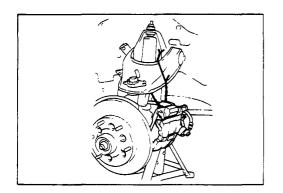
- 1. Bolt
- ▲ 2. Brake caliper
- ▲ 3. Hub cap
  - 4. Split pin
  - 5. Nut retainer
  - 6. Hub nut
  - 7. Lock washer

- 8. Outer bearing
- 9. Hub and disc assembly
  - 10. Oil seal
  - 11. Inner bearing and outer race
- ▲ 12. Bolt
- ▲ 13. Wheel pin



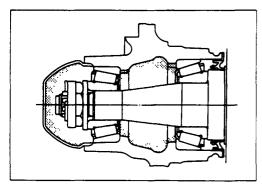
# **Important Operations**

Before removal, jack up the front of vehicle and support frame with jack stands.



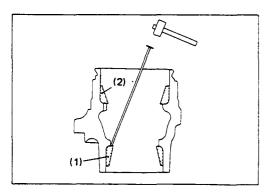
# 2. Brake Caliper

- (1) Remove the two bolts from the rear side of the knuckle arm, then remove the brake caliper, with the brake hose attached.
- (2) Use a wire etc., for attaching the brake caliper to the upper link.



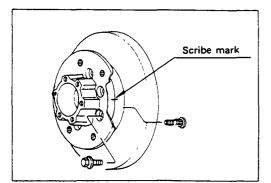
# 3. Hub Cap

When removing hub cap, exercise care so as not to scratch or distort hub fitting face.



#### 9. Hub and Disc Assembly

Using a brass bar to remove the outer bearing outer race (1), oil seal, inner bearing and inner bearing outer race (2) from the hub.

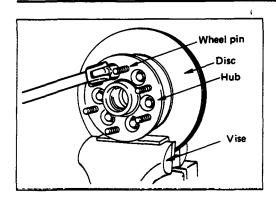


If necessary, replace the wheel pin in the following manner.

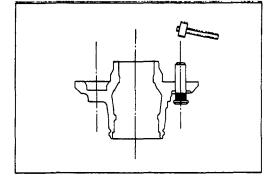
#### 12. Bolt

# 13. Wheel Pin; Front Hub

(1) Scribe mark on hub to disc before disassembly to insure proper assembly.



 Clamp hub and disc assembly in vise using protective pads and remove six (6) disc to hub retaining bolts.



(3) Place hub on a suitable work surface and remove wheel studs, as required, using a hammer.



# **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

- Hub
- Hub bearing
- Bearing outer race
- Disc
- Oil seal

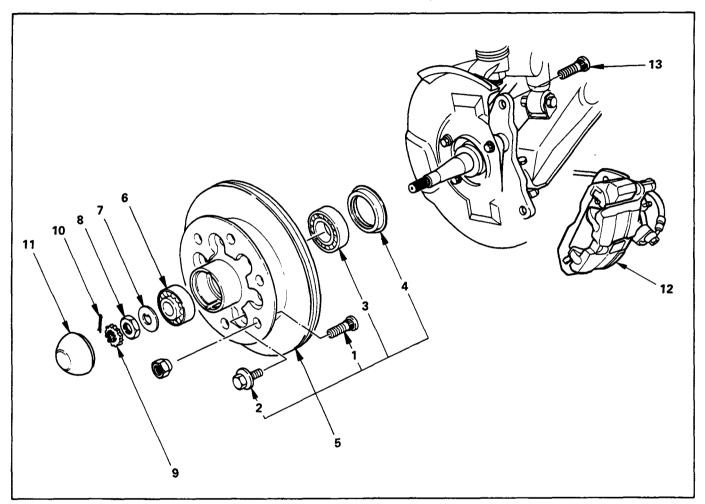


#### **Visual Check**

Check the following parts for wear, damage or other abnormal conditions.

# REASSEMBLY

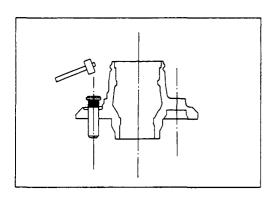
Refer to SECTION 3E "WHEEL AND TIRE" for wheel installation procedure.



# Reassembly steps

- ▲ 1. Wheel pin
- 2. Bolt
- ▲ 3. Inner bearing and outer race
- 4. Oil seal
- ▲ 5. Hub and disc assembly
  - 6. Outer bearing
  - 7. Lock washer

- ▲ 8. Hub nut
  - 9. Nut retainer
  - 10. Split pin
- ▲11. Hub cap
  - 12. Brake caliper
- ▲ 13. Bolt



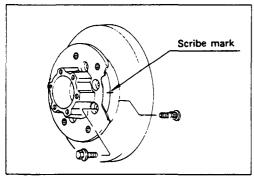


# **Important Operations**

#### 1. Wheel Pin

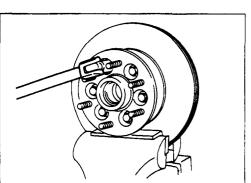
- (1) Place hub on a wood workbench or a block of wood, approx. 6" by 6" to protect the wheel stud ends and threads.
- (2) Install wheel stud using a hammer.

  Be sure wheel stud is started squarely and seats completely.





(3) Align index marks and install hub to disc.



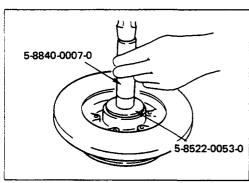


## 2. Bolt

Torque

kg·m(lb.ft/N·m)

 $10.5 \pm 1 (75.9 \pm 7.2/103 \pm 5)$ 





## 3. Inner Bearing and Outer Race

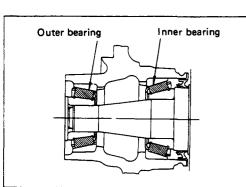
#### 4. Oil Seal

- ▲ Outer Bearing Outer Race
- (1) Install the bearing outer race by driving into the hub.

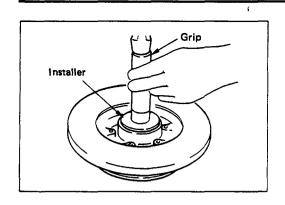
Installer (Outer) : 5-8822-0053-0 (J-29016)

Installer (Inner) : 5-8822-0054-0 (J-29015)

Drive handle : 5-8840-0007-0 (J-8092)



(2) Install the outer and inner bearing into the hub with fingers.





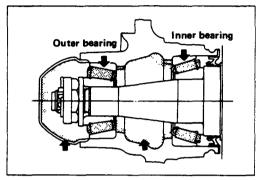
(3) Install oil seal using special tools.

Installer: 5-8522-0051-0

(J-33161)

Grip: 5-8840-0007-0

(J-8092)



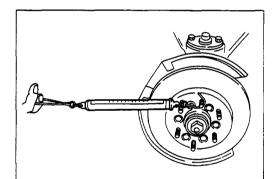


# 5. Hub and Disc Assembly

# 11. Hub Cap

Apply grease in the hub and hub cap.

	Amount g(oz)
Hub	50 (1.76)
Hub cap	20 (0.70)
Outer bearing	6.5 (0.23)
Inner bearing	12 (0.42)





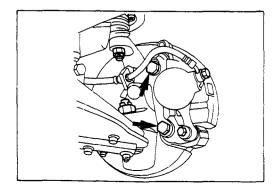
#### 8. Hub nut

# Adjustment of front wheel hub bearing preload

- 1. Tighten spindle nut to 3.0 kg·m (21.7 lb.ft/29.4 N·m) torque.
- 2. Turn the hub 2-3 turns and loosen the nut just enough so that it can be turned with the fingers.
- 3. Turn the nut all the way in with the fingers and check to be sure the hub has no free play.
- 4. Measure the bearing preload by pulling one of the wheel hub studs with a spring scale.
- 5. Tighten the spindle nut until specified bearing preload is obtained.

After reassembling, install the disc brake caliper assembly.

Bearing Preload	kg(lb)	
New bearing and New oil seal	0.8-1.0 (1.8-2.2)	
Reuse bearing and New oil seal	0.8-1.0 (1.8-2.2)	



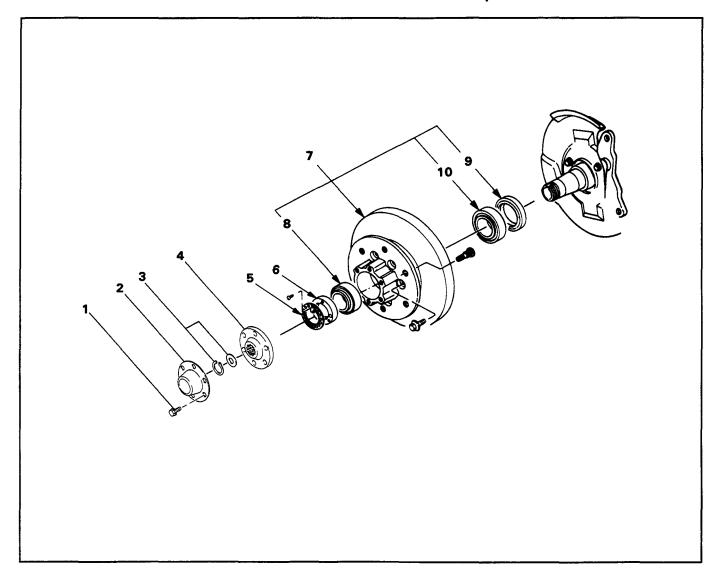
## 13. Bolt

Torque	_			kg∙n	n(lb.ft/N·m)
15.8	± 1.6	(114.3	± 11.6/155	± 18	5.7)

# FRONT HUB AND DISC (4×4 model)



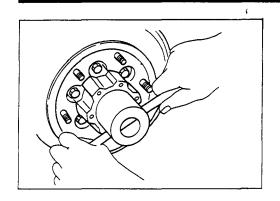
Refer to SECTION 3E "WHEEL AND TIRE" for wheel removal procedure



# Disassembly steps

- 1. Bolt
- 2. Hub cap
- 3. Snap ring and shim
- 4. Flange
- 5. Lock washer

- ▲6. Hub nut
- ▲7. Hub and disc assembly
- 8. Outer bearing
- 9. Oil seal
- 10. Inner bearing





# Important operations

## 6. Hub nut

Whench ;5-8840-2117-0 (J-36827)

Refer to Section 5 "Brake" for disc brake caliper removal procedure.

# 7. Hub and disc assembly

Before disassembly, remove the disc brake caliper assembly and hang it on the frame with wires.



# INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

For inspection and servicing of disc caliper, and relative parts, refer to Section 5 "Service Brakes".

- Hub
- Hub bearing, oil seal
- Knuckle spindle
- Disc
- Caliper
- Free wheeling hub parts (Option)
- Clutch, knob, follower, inner, ring and spring



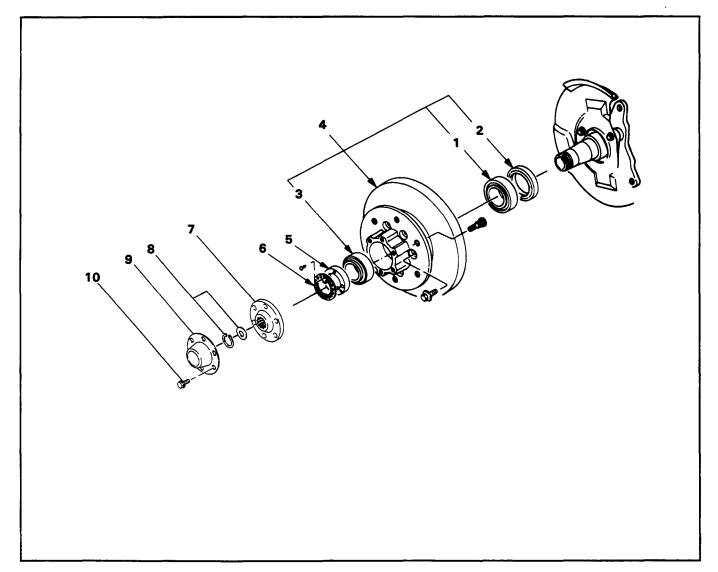
#### Visual Check

Inspect the following parts for wear, damage or other abnormal conditions.

# ♣ RE

# **REASSEMBLY**

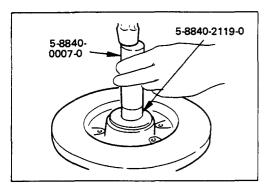
# Refer to SECTION 3E "WHEEL AND TIRE" for wheel installation procedure



# Reassembly steps

- ▲ 1. Inner bearing
- ▲ 2. Oil seal
- ▲ 3. Outer bearing
- ▲ 4. Hub and disc assembly
- ▲ 5. Hub nut

- ▲ 6. Lock washer
  - 7. Flange
- ▲ 8. Snap ring and shim
  - 9. Hub cap
- ▲10. Bolt





# Important operations



#### 1. Inner Bearing

Outer race; outer bearing

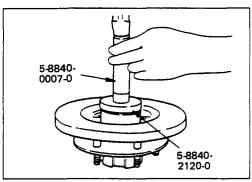
Install the outer race by driving it into the hub.

Installer: 5-8840-2119-0

(J-36829)

Grip : 5-8840-0007-0

(J-8092)





#### 2. Oil Seal

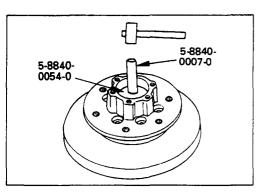
Installer: 5-8840-2120-0

(J-36830)

Grip : 5-8840-0007-0

(J-8092)

Apply grease (Besco L-2 or equivalent) to the lip portion.





# 3. Outer bearing

Outer race; outer bearing

Install the outer race by driving it into the hub.

Installer: 5-8840-0054-0

(J-29015)

Grip : 5-8840-0007-0

(J-8092)

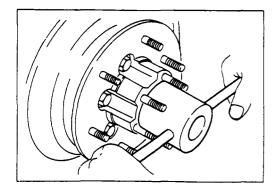


#### 4. Hub and Disc Assembly

(1) Apply grease in the hub.

(2) Apply grease (Besco L-2 or equivalent) to the outer and inner bearing.

	g(o
Hub	35 (1.23)
Outer bearing	10 (0.35)
Inner bearing	15 (0.53)

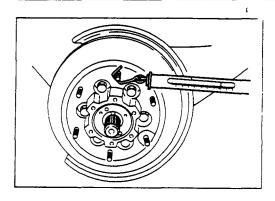




#### 5. Hub Nut

(1) Turn the place where there is a chamfer in the tapped hole to the outer side, and attach the nut.

Wrench: 5-8840-2117-0 (J-36827)





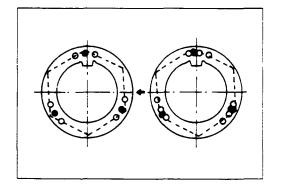
#### **Preload Adjustment**

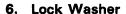
Tighten the hub nut at 3 kg·m (21.716 lb.ft/29.4 N·m), then loosen the nut to the full.

Tighten the hub nut at the value given below, using  $\alpha$  spring scale on the wheel pin.

Bearing Preload	kg(lb)
New bearing and New oil seal	2 -2.5 (4.4-5.5)
Used bearing and New oil seal	1.2-1.8 (2.6-4.0)

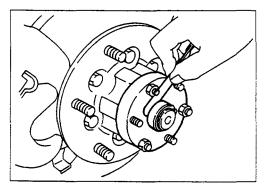
If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.





Turn the side with larger diameter of the tapered bore to the vehicle outer side, and attach the washer.

If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate. If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment. Screw is to be fastened tightly so its head may come lower than the surface of the washer.





# 8. Snap ring, shims

Adjust the clearance between the collar and the snap ring.

Clearance	mm(in.)	0-0.3 (0-0.01)

Adjust shims available

mm(in.)

0.2, 0.3, 0.5, 1.0 (0.008, 0.011, 0.020, 0.039)

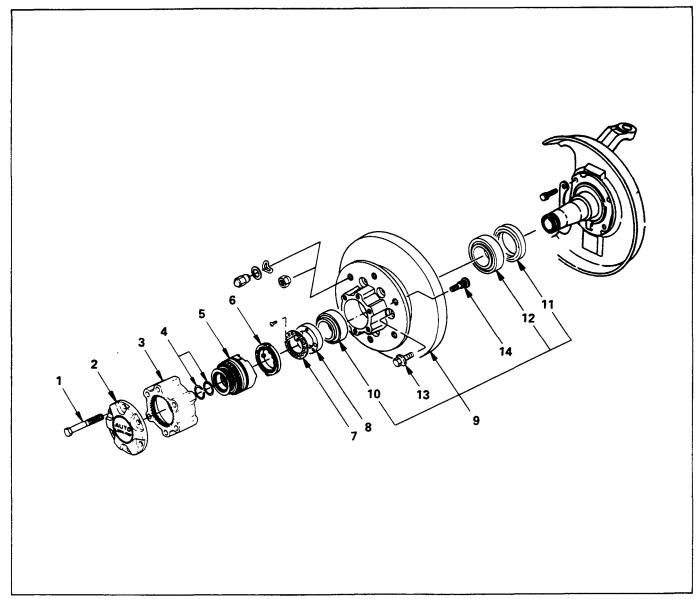


#### 10. Bolt

Torque kg·m(lb.ft/N·m)	1.0-1.4 (7-10/10-14)
<del></del>	<u> </u>

# FRONT HUB AND DISC (Automatic Locking Hub)

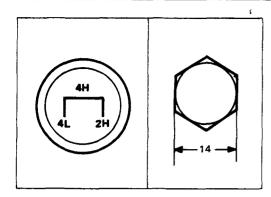




# **Disassembly Steps**

- ▲ 1. Bolt
  - 2. Hub cap
  - 3. Housing assembly
  - 4. Snap ring and shims
  - 5. Drive clutch assembly
  - 6. Inner cam
  - 7. Lock washer

- ▲ 8. Hub nut
- 9. Hub and disc assembly
- ▲ 10. Outer bearing and outer race
  - 11. Oil seal
- ▲ 12. Inner bearing and outer race
- ▲13. Bolt
- ▲ 14. Wheel pin





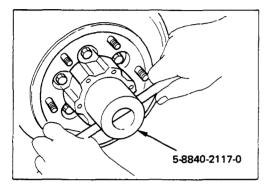
 $\Theta$ 

# **Important Operations**

#### 1. Bolt

Shift the transfer lever to the "2H" position and move the vehicle forward and rearward about one meter.

Remove the 14 mm hex holts



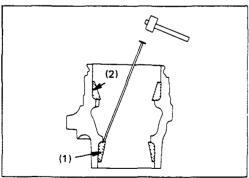
#### 8. Hub Nut

Wrench: 5-8840-2117-0

(J-36827)

#### 9. Hub and Disc Assembly

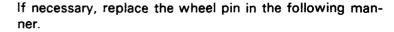
Before disassembly, remove the disc brake caliper assembly and hang it on the frame with wires.



#### 10. Outer Bearing and Outer Race

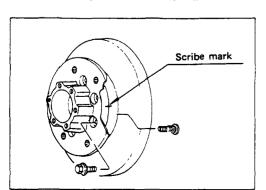
#### 12. Inner Bearing and Outer Race

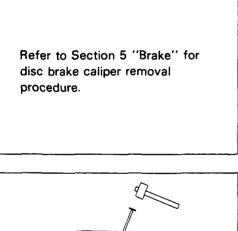
- (1) Remove the outer bearing from the hub with fingers. The inner bearing will remain in the hub and may be removed after prying out the inner bearing lip seal assembly.
- (2) Remove the outerrace by driving out the race from the hub with a brass drift inserted behind the race in the notches in the hubs.



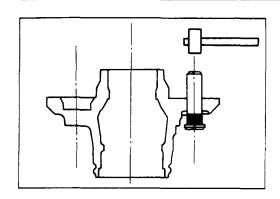
#### 13. Bolt

- (1) Apply a scribe mark to disc to hub.
- (2) Clamp the hub and disc assembly in a vise using protective pads and remove the 6 disc to hub retaining bolts.





#### 4C-56 FRONT WHEEL DRIVE



#### 14. Wheel Pin

Place pins hub on a suitable work surface and remove the wheel studs, as required, using a hammer.



# **INSPECTION AND REPAIR**

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

For inspection and servicing of disc caliper, and relative parts, refer to Section 05 "Brakes".

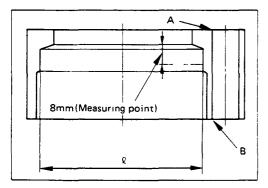


- . Hub bearing, oil seal
- Knuckle spindle
- Disc
- Caliper
- Automatic locking hubs



#### Visual Check

Inspect the following parts for wear, damage, or other abnormal conditions.

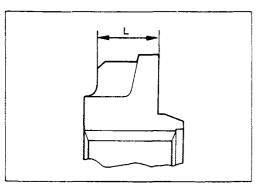




#### Inside Diameter of Housing

	mm(in)
Standard	Limit
65.04 (2.561)	65.24 (2.568)

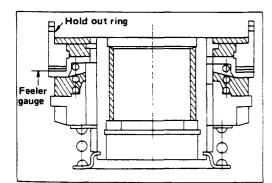
Inspect flange surface A and B for excessive wear.





#### Drive Clutch Section Dimensions "L"

	mm(in)
Standard	Limit
8.2 (0.323)	7.8 (0.307)

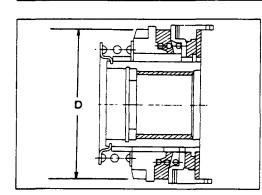




# Holdout Ring Axial Play of the Drive Clutch Assembly

	mm(in
Standard	Limit
0.3 (0.012) or less	0.4 (0.016)

# 4C-58 FRONT WHEEL DRIVE

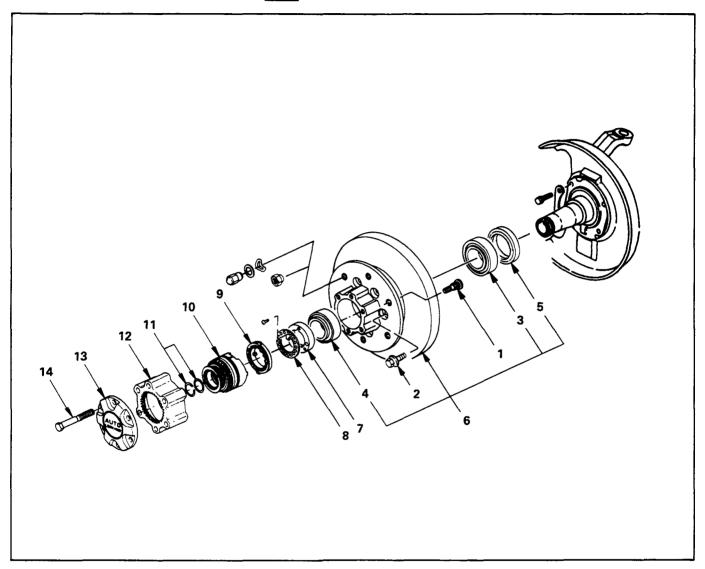




# Outside Diameter of the Drive Clutch Assembly

Standard	Limit
64.75 (2.55)	64.55 (2.54

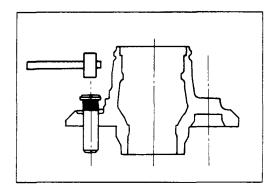
# REASSEMBLY



# **Reassembly Steps**

- ▲ 1. Wheel pin
- 2. Boit
- ▲ 3. Inner bearing and outer race
- ▲ 4. Outer bearing and outer race
- ▲ 5. Oil seal
- ▲ 6. Hub and disc assembly
- ▲ 7. Hub nut

- ▲ 8. Lock washer
- ▲ 9. Inner cam
- ▲ 10. Drive clutch assembly
- ▲ 11. Snap ring and shim
- ▲ 12. Housing assembly
  - 13. Hub cap
  - 14. Washer and bolt



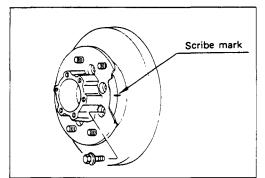


# **Important Operations**

#### 1. Wheel Pin

- (1) Place the hub on a wood workbench or a block of wood approx 6" by 6" to protect the wheel stud ends and threads.
- (2) Insert a wheel stud using a hammer.

  Be sure the wheel stud is started squarely and seats completely.

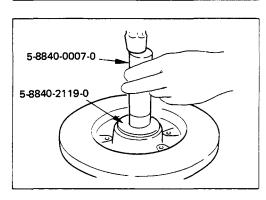




#### 2. Bolt

Align scribe marks and attach the hub to the disc.

Torque				kg·m(lb.ft/N·m)
	10.5 ±	1 (75.9	± 7.2/103	± 5)





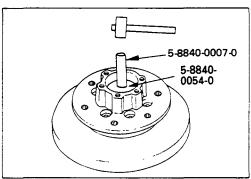
#### 3. Inner Bearing and Outer Race

Outer race; inner bearing

Install the outer race by driving it into the hub.

Installer : 5-8840-2119-0 (J-36829)

Grip: 5-8840-0007-0 (J-8092)





#### 4. Outer Bearing and Outer Race

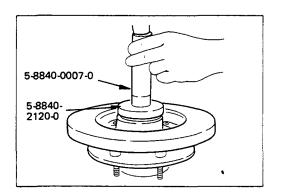
Outer race; outer bearing

Install the outer race by driving it into the hub.

Installer : 5-8840-0054-0 (J-29015)

Grip: 5-8840-0007-0

(J-8092)





#### 5. Oil Seal

Place the inner bearing onto the outer race in the hub and install a new oil seal and retaining ring.

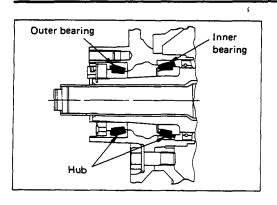
Apply Besco L-2 or equivalent to the lip portion.

Installer: 5-8840-2120-0

(J-36830)

Grip: 5-8840-0007-0

(J-8092)

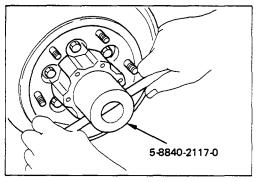




#### 6. Hub and Disc Assembly

- (1) Put grease in the hub.
- (2) Apply Besco L-2 or equivalent to the outer and inner bearing.

	g(oz)
Hub	35 (1.23)
Outer bearing	10 (0.35)
Inner bearing	15 (0.53)

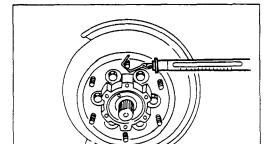




#### 7. Hub Nut

Turn the place where there is a chamfer in the tapped hole to the outer side, and attach the nut.

Wrench: 5-8840-2117-0 (J-36827)





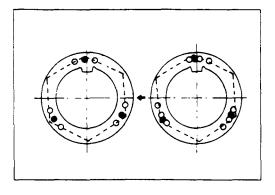
#### ▲ Preload Adjustment

Tighten the hub nut at 3 kg·m (21.716 lb.ft/29.4 N·m), then loosen the nut to the full.

Tighten the hub nut at the value given below, using a spring scale on the wheel pin.

Bearing Preload	kg(lb)
New bearing and New oil seal	2 -2.5 (4.4-5.5)
Used bearing and New oil seal	1.2-1.8 (2.6-4.0)

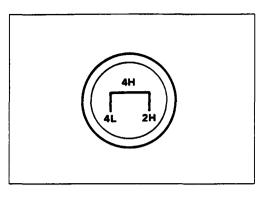
If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



#### 8. Lock Washer

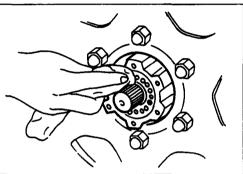
Turn the side with larger diameter of the tapered bore to the vehicle outer side, and attach the washer. If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.

If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment. Screw is to be fastened tightly so its head may come lower than the surface of the washer.



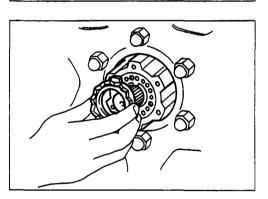
#### 9. Inner Cam

(1) Before installation, shift the transfer lever to "2H" position.



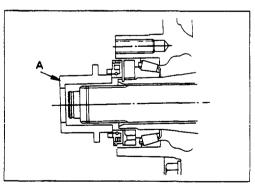


(2) Clean the flange surface of the hub, the thread holes, the surface of the lock washer and the spline portion of the axle shaft.





(3) Install the inner cam by aligning the key way of the inner cam with the groove of the knuckle. Hit the inner cam lightly with plastic hammer or equivalent and make sure the inner cam is in contact with the lock washer.





If it is difficult to install the inner cam, use the tool (installer) and a plastic hammer or the equivalent.

Install the special tool.

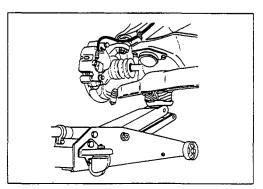
Use the plastic hammer to lightly tap around the special tool "A" surface as shown in the illustration.

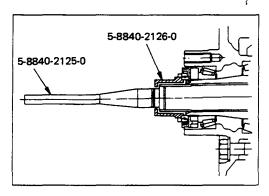
Installer: 5-8840-2137-0 (J-38194)

**Note:** Do not strike the inner cam gear teeth with the plastic hammer.



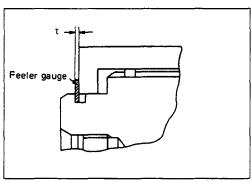
- (1) Lower vehicle from hoist.
- (2) Support lower link with floor jack, placing axle in normal horizontal position.





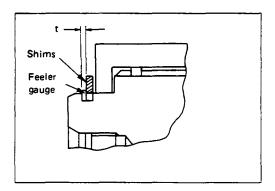


(3) Install special tool 5-8840-2126-0 to axle shaft by 5-8840-2125-0 until it comes into contact with the lock washer.



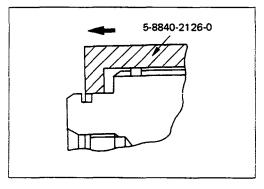


(4) Using feeler gauge, measure clearance "t" between the special tool and the snap ring groove of the axle shaft.



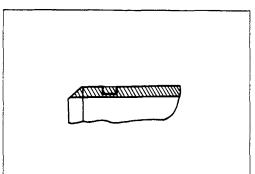
(5) If clearance "t" is larger than snap ring groove, shims must be installed select shims so that clearance "t" is 0 to 0.1 mm (0 to 0.0039 in).

Thickness shims; 0.2, 0.3, 0.5, 1.0 mm





(6) Remove special tool 5-8840-2126-0, leaving the inner cam in position.

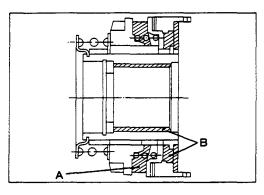


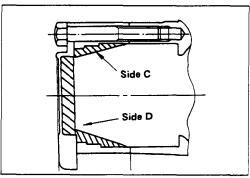


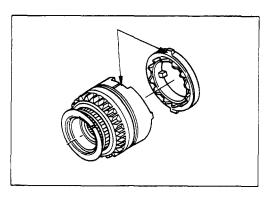
#### 10. Drive Clutch Assembly

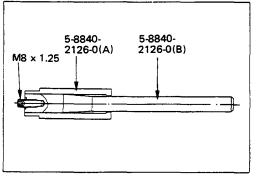
Apply multipurpose grease or hub bearing grease to the following portions.

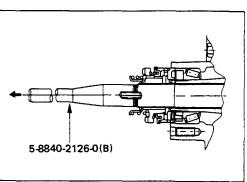
(1) Axle shaft splines











• "A" groove and "B" portion

7 (0.05)
7 (0.25)
3 (0.11)

"C" circumference and "D" portion

	g(oz)
"C" circumference	8 (0.29)
"D" portion	4 (0.15)

- (2) Align the cut part of the drive clutch assembly with the concave part of inner cam.
- (3) Engage the cam teeth of the drive clutch assembly to that of the inner cam by turning the axle shaft.



#### 11. Snap Ring and Shims

(1) Install shims (selected above) to axle by hand.

#### Note:

Always use a new snap ring.

- (2) Install special tool 5-8840-2126-0 (B) to axle.
- (3) Install snap ring to tool.
- (4) Install tool driver 5-8840-2126-0 (A).
- (5) Pull out the axle shaft fully by pulling the tool 5-8840-2126-0 (B) and install snap ring to axle by pushing on tool driver 5-8840-2126-0 (A).
- (6) Remove tool from axle.

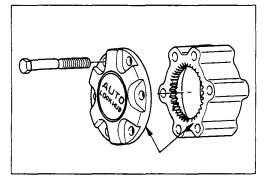
Snap ring installer: 5-8840-2126-0

(J-36835)



## Caution

After installation of the shims and the snap ring, check the fitting condition of the snap ring.







#### 12. Housing Assembly

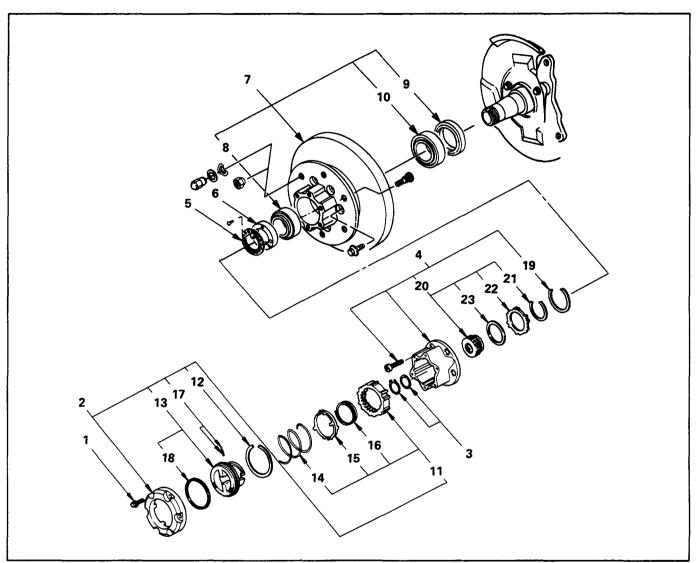
- (1) Apply Loctite 515 or the equivalent to the flange surface of the housing assembly.
- (2) Make sure that the housing assembly turns smoothly. If it turns smoothly, the spacer selected above is correct.
- (3) Bolt tightening torque:

Torque	kg·m(lb.ft/N·m)

 $6 \pm 0.5 (43.4 \pm 3.6/58.9 \pm 5)$ 

# FRONT HUB AND DISC (Manual Locking Hub)

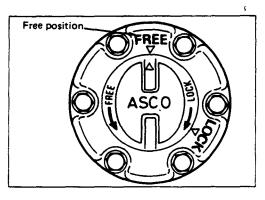
# DISASSEMBLY



# **Disassembly Steps**

- ▲ 1. Bolt
  - 2. Housing assembly
  - 3. Snap ring and shims
  - 4. Body assembly
  - 5. Lock washer
- ▲ 6. Hub nut
- ▲ 7. Hub and disc assembly
  - 8. Outer bearing
  - 9. Oil seal
  - 10. Inner bearing
- ▲ 11. Clutch assembly

- 12. Snap ring
- 13. Knob
- 14. Compression spring
- 15. Follower
- ▲ 16. Retaining spring
  - 17. Detent ball and spring
  - 18. X-ring
  - 19. Snap ring
  - 20. Inner assembly
  - 21. Snap ring
  - 22. Ring
  - 23. Spacer

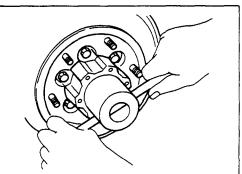




# **Important Operations**

#### 1. Bolt

Before removal, shift transfer lever into "2H" position and set free wheeling hub knob into "FREE" position.





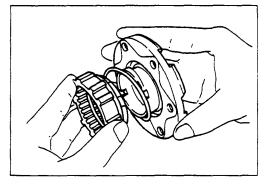
#### 6. Hub Nut

Wrench: 5-8840-2117-0 (J-36827)

Refer to Section 5 "Brake" for disc brake caliper removal procedure.

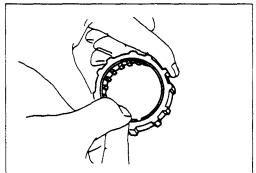


Before disassembly, remove the disc brake caliper assembly and hang it on the frame with wires.



# 11. Clutch Assembly

While pushing follower knob, turn clutch assembly clockwise and then remove clutch assembly from knob.



### 16. Retaining Spring

Remove retaining spring from clutch assembly by turning it counterclockwise.



# **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

For inspection and servicing of disc caliper, and relative parts, refer to Section 05 "Service Brakes".

- Hub
- Hub bearing, oil seal
- Knuckle spindle
- Disc
- Caliper
- Free wheeling hub parts (Option)
- Clutch, knob, follower, inner, ring and spring

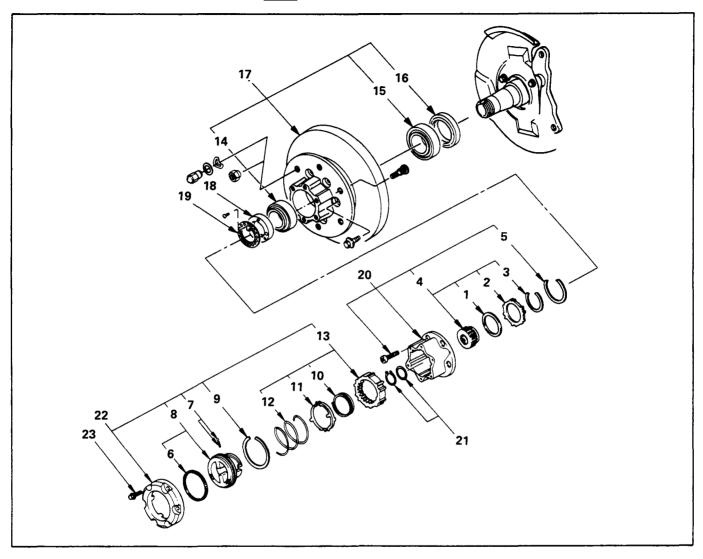


#### **Visual Check**

Inspect the following parts for wear, damage or other abnormal conditions.

# +\*+

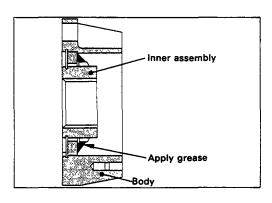
# **REASSEMBLY**



# **Reassembly Steps**

- ▲ 1. Spacer
  - 2. Ring
  - 3. Snap ring
- ▲ 4. Inner assembly
  - 5. Snap ring
  - 6. X-ring
  - 7. Detent ball and spring
- ▲ 8. Knob
- ▲ 9. Snap ring
- ▲ 10. Retaining spring
- ▲11. Follower
- ▲ 12. Compression spring

- ▲ 13. Clutch assembly
- ▲ 14. Outer bearing
- ▲ 15. Inner bearing
- ▲ 16. Oil seal
- ▲ 17. Hub and disc assembly
- ▲ 18. Hub nut
- ▲ 19. Lock washer
- ▲ 20. Body assembly
- ▲ 21. Snap ring and shims
- ▲ 22. Cover assembly
- ▲23. Bolt





#### **Important Operations**



#### 1. Spacer

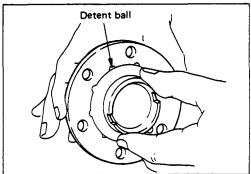
Apply grease to both faces of spacer.



## 4. Inner Assembly

Apply grease wheel bearing to inside face of ring.

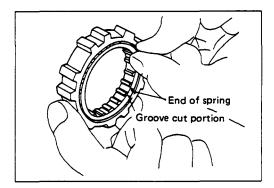
	g(oz)
Amount of grease	3 (0.10)





#### 8. Knob

- (1) Apply grease wheel bearing to outer circumference of knob and inner circumference of cover.
- (2) Align detent ball to either groove of cover.





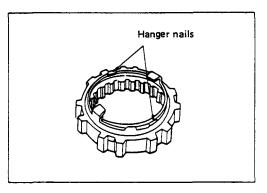
#### 9. Snap Ring

Turn the smoother face to knob side.



#### 10. Retaining Spring

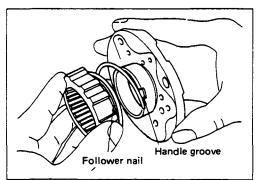
Align the end of spring to the end of cut portion of clutch spring groove.





#### 11. Follower

Install follower to clutch so that follower nail will come closer to the bent portion of retaining spring by aligning follower stopper nail to outer teeth of clutch. Then, hook retaining spring onto upper portion of hanger nails of follower.



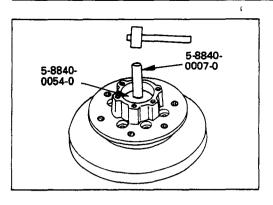


#### 12. Compression Spring.

Turn the smaller diameter side to follower.

# 13. Clutch Assembly

Align follower nail to handle groove, and then assemble clutch with knob by pushing and turning clutch counterclockwise to knob.





#### 14. Outer Bearing

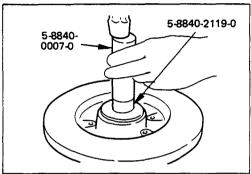
Outer race; outer bearing

Install the outer race by driving it into the hub.

Installer : 5-8840-0054-0 (J-29015)

Grip : 5-8840-0007-0

(J-8092)





#### 15. Inner Bearing

Outer race; outer bearing

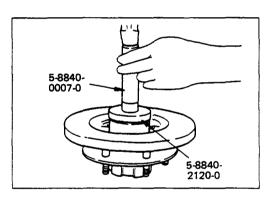
Install the outer race by driving it into the hub.

Installer: 5-8840-2119-0

(J-36829)

Grip : 5-8840-0007-0

(J-8092)





#### 16. Oil Seal

Installer: 5-8840-2120-0

(J-36830)

Grip : 5-8840-0007-0

(J-8092)

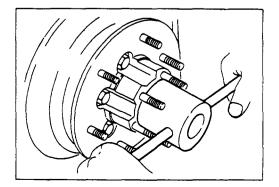
Apply grease (Besco L-2 or equivalent) to the lip portion.



# 17. Hub and Disc Assembly

- (1) Apply grease in the hub.
- (2) Apply grease (Besco L-2 or equivalent) to the outer and inner bearing.

	glo
Hub	35 (1.23)
Outer bearing	10 (0.35)
Inner bearing	15 (0.53)



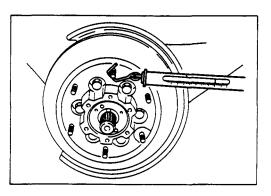


#### 18. Hub Nut

(1) Turn the place where there is a chamfer in the tapped hole to the outer side, and attach the nut.

Wrench: 5-8840-2117-0

(J-36827)





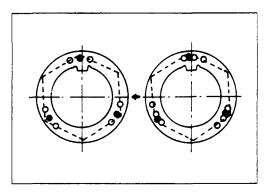
#### **Preload Adjustment**

Tighten the hub nut at 3 kg·m (21.716 lb.ft/29.4 N·m), then loosen the nut to the full.

Tighten the hub nut at the value given below, using a spring scale on the wheel pin.

Bearing Preload	kg(lb)
New bearing and New oil seal	2 -2.5 (4.4-5.5)
Used bearing and New oil seal	1.2-1.8 (2.6-4.0)

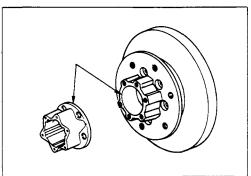
If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



#### 19. Lock Washer

Turn the side with larger diameter of the tapered bore to the vehicle outer side, and attach the washer.

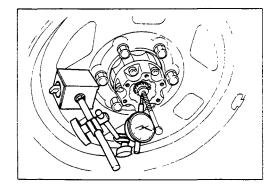
If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate. If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment. Screw is to be fastened tightly so its head may come lower than the surface of the washer.





# 20. Body Assembly

Apply adhesive (Loctite 515 or equivalent) to the both joining faces.





## 21. Snap Ring and Shims

Adjust the clearance between the free wheeling hub body and the snap ring.

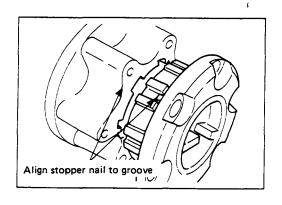
Clearance		<u>mm(in)</u>
	0 - 0.3 (0 - 0.01)	
•		

mm(in)

Adjust Shims Available

0,2, 0.3, 0.5, 1.0

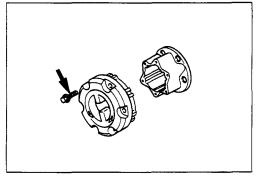
(0.008, 0.011, 0.020, 0.039)





## 22. Cover Assembly

Align stopper nails to grooves of body.





#### 23. Bolt

Torque kg·m(lb.ft/N·m)

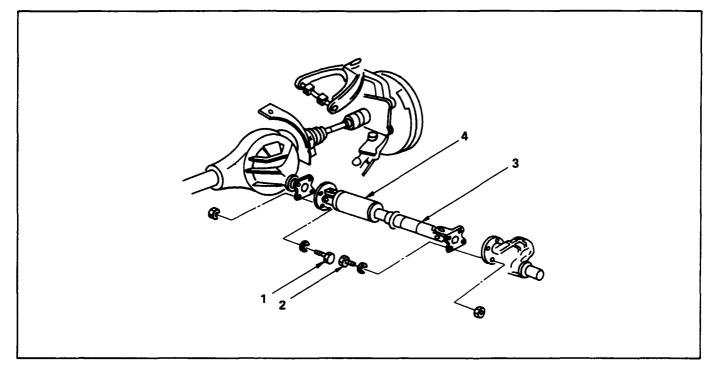
 $1.2 \pm 0.2 (8.7 \pm 1.4/11.8 \pm 2.0)$ 

# FRONT PROPELLER SHAFT



# ++

# **REMOVAL AND INSTALLATION**



Since the propeller shaft assembly is carefully balanced, a setting mark should be applied to the flange before removal to indicate correct position.

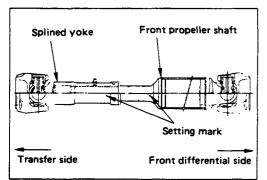
Install the parts by aligning the setting marks made at removal.

## **Removal Steps**

- 1. Bolt : differential side
- 2. Bolt : transfer side
- 3. Propeller shaft assembly; rear side
- 4. Propeller shaft assembly; front side

#### **Installation Steps**

- 4. Propeller shaft assembly; front side
- ▲ 3. Propeller shaft assembly; rear side
- ▲ 2. Bolt ; transfer side
- ▲ 1. Bolt; differential side





#### Important Operation - Installation



# 3. Propeller Shaft Assembly; Rear Side

Align the indexing marks (about 3 mm dia. punched mark) on the propeller shaft end and the splined yoke.

# FRONT WHEEL DRIVE 4C-75



#### 2. Bolt ; Transfer Side

Torque	kg·m(lb.ft/N·m)
2.6L Engine	$6.4 \pm 0.4 \ (46.3 \pm 2.9/62.8 \pm 3.9)$

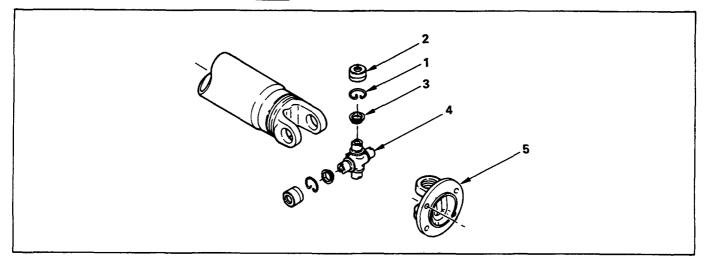


#### 1. Bolt; Differential Side

Torque	kg·m(lb.ft/N·m)
2.6L Engine	$6.4 \pm 0.4 \ (46.3 \pm 2.9/62.8 \pm 3.9)$



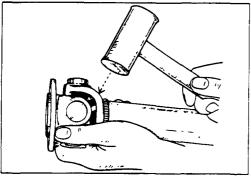
# **DISASSEMBLY**

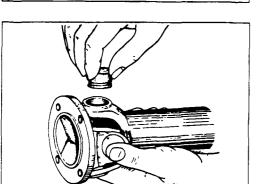


# **Disassembly Steps**

- 1. Snap ring
- ▲ 2. Needle roller bearing
  - 3. Seal

- 4. Spider
- 5. Flange yoke







# **Important Operation**

# 2. Needle Roller Bearing

- (1) Tap out the bearing by striking the shoulder of the yoke using a mallet or a copper hammer.
  - Remove the needle roller bearing in position by tapping lightly on the spider.
  - Remove the remaining bearings in the similar manner.
- (2) As the yoke is tapped, the needle roller bearing comes out gradually, permitting easy removal with hand.



# **INSPECTION AND REPAIR**

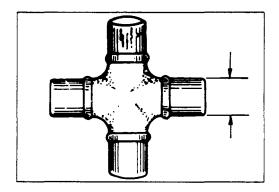
Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

Spider Needle roller bearing Yoke Flange Center bearing Cushioning rubber Bracket



#### Visual Check

Inspect following parts for wear, damage, or other abnormal conditions.

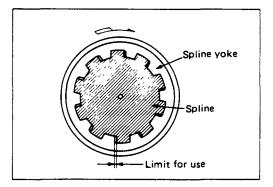




#### **Outside Diameter of Spider Pins**

mm(in)

Standard	Limit
17.000 (0.669)	16.90 (0.665)





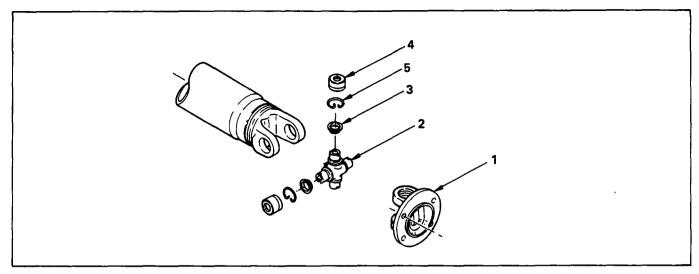
## Play in Splines in Normal Direction of Rotation

Check the amount of play in the sleeve yoke and propeller shaft splines in the direction of rotation, using a pointed feeler gauge.

	mm(in)
Standard	Limit
0.074 — 0.156 (0.003 — 0.006)	0.3 (0.012)



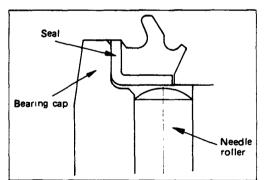
# REASSEMBLY



# **Reassembly Steps**

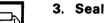
- 1. Flange yoke
- 2. Spider
- 3. Seal

- ▲ 4. Needle roller bearing
- ▲ 5. Snap ring



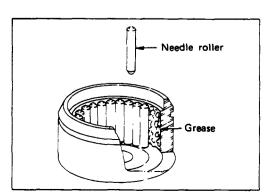


# **Important Operations**



Discard the used seal and install a new one.

Push the seal in until its outer surface is flush against the bearing cap surface.





## 4. Needle Roller Bearing

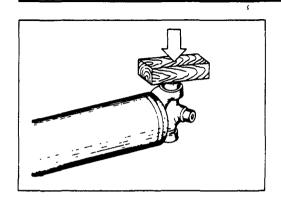
 Apply a molybdenum-disulfide grease or a multipurpose type grease NLG1 No. 2 to the bearing cap inner surface.

Install the needle rollers.

Amount of grease required

g(oz)

Approx. 1.2 (0.042)



(2) Attach the spider to the yoke and then insert the needle roller bearing cap into the hole by using a wood block and a hammer or a press.



# 5. Snap Ring

When the bearing cap is in position, select and attach a snap ring of suitable thickness so that the end play of the spider pin is held within 0.1 mm (0.004 in.).

mm(in)

Snap ring thickness	Identifity color
1.5 (0.059)	Blue
1.545 (0.061)	White
1.59 (0.063)	Yellow
1.635 (0.064)	Green
1.68 (0.066)	Not color

# **TROUBLESHOOTING**

Refer to this Section to quickly diagnose and repair front axle problems. Each troubleshooting chart has three headings arranged from left to right.

(1) Checkpoint

(2) Trouble Cause

(3) Countermeasure

This Section is divided into ten sub-sections:

#### 4 x 2 Model

- 1. Wanders and pulls
- 2. Front wheel shimmy

#### 4 x 4 Model

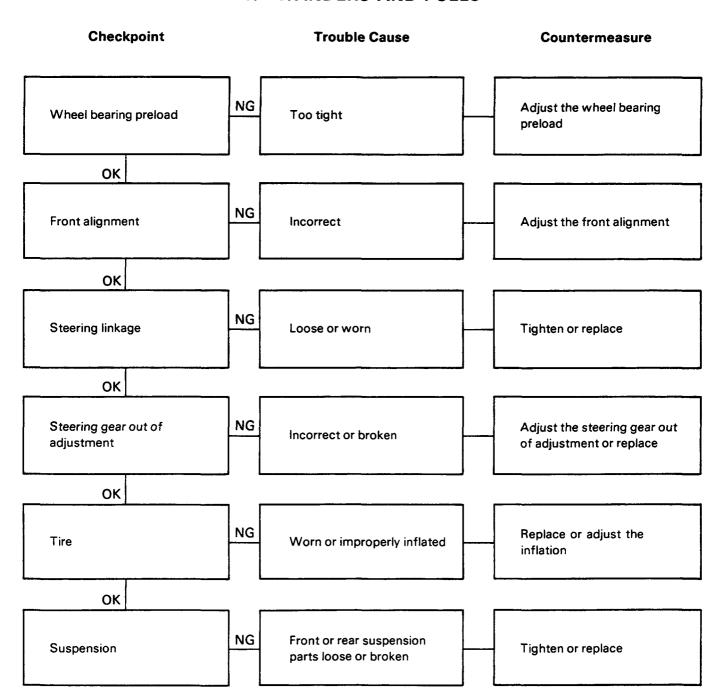
- 1. Oil leak at front axle
- 2. Oil leak at pinion shaft
- 3. Noises in front axle drive shaft joint
- 4. Noises in front axle
- 5. Wanders and pulls
- 6. Front wheel shimmy
- 7. Automatic locking free wheel hub
  - 1) Does not lock or locks only on one side
  - 2) Does not freewheel or freewheels only to one side
  - 3) Noises in automatic locking free wheel hub

#### **Propeller Shaft**

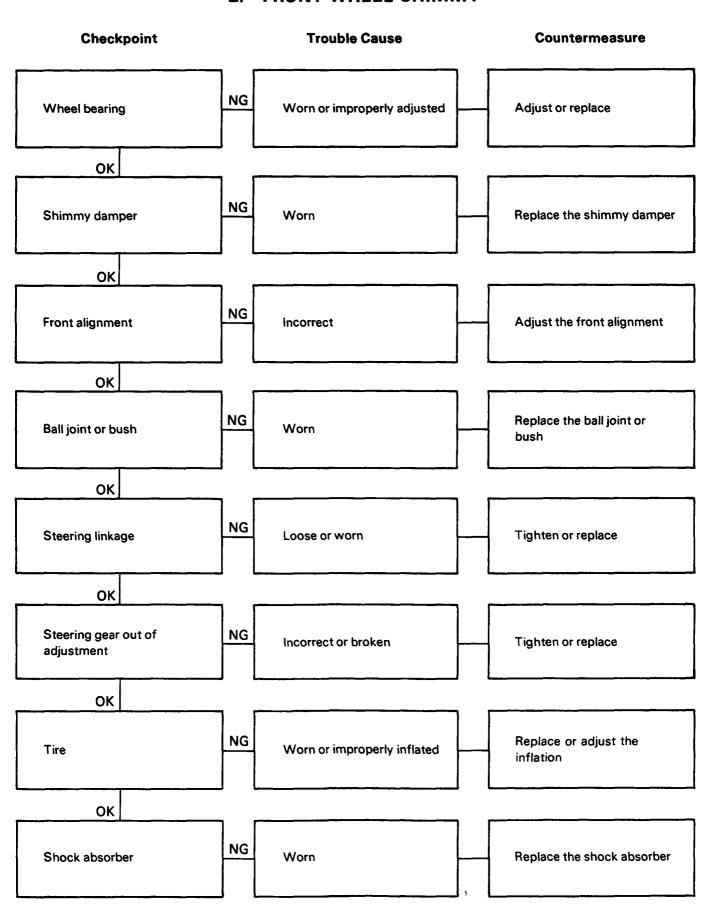
- 1. Noise
- 2. Vibration

# 4 x 2 MODEL

## 1. WANDERS AND PULLS

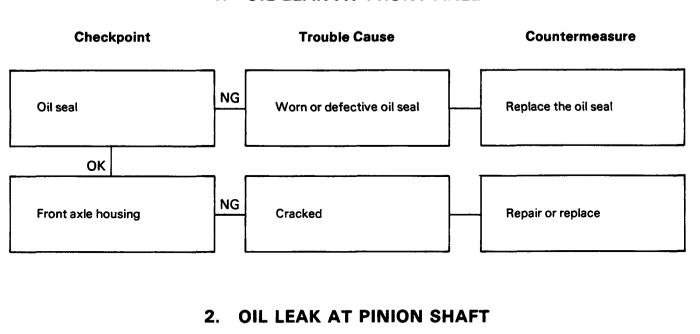


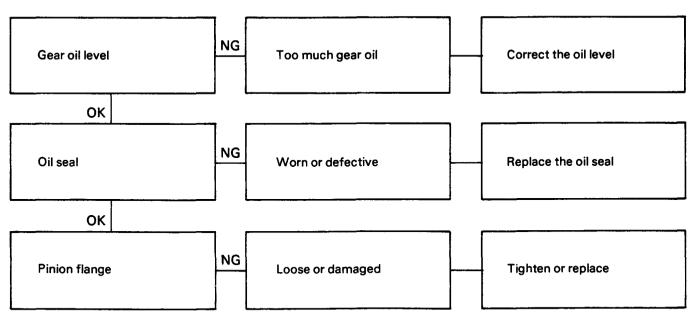
# 2. FRONT WHEEL SHIMMY



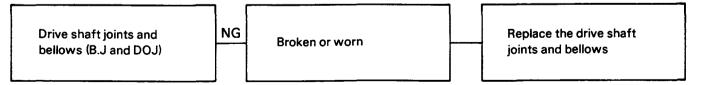
# 4 x 4 MODEL

# 1. OIL LEAK AT FRONT AXLE

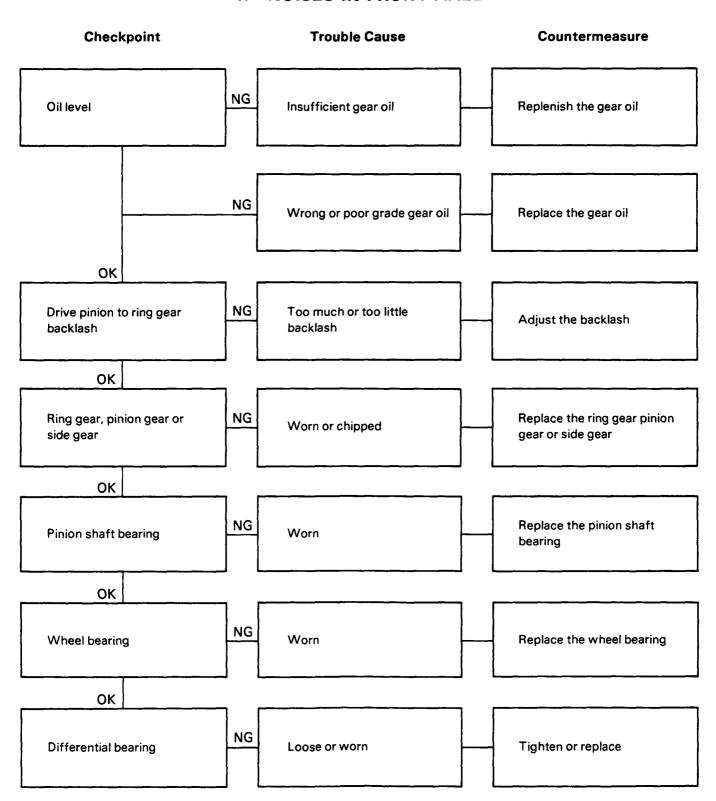




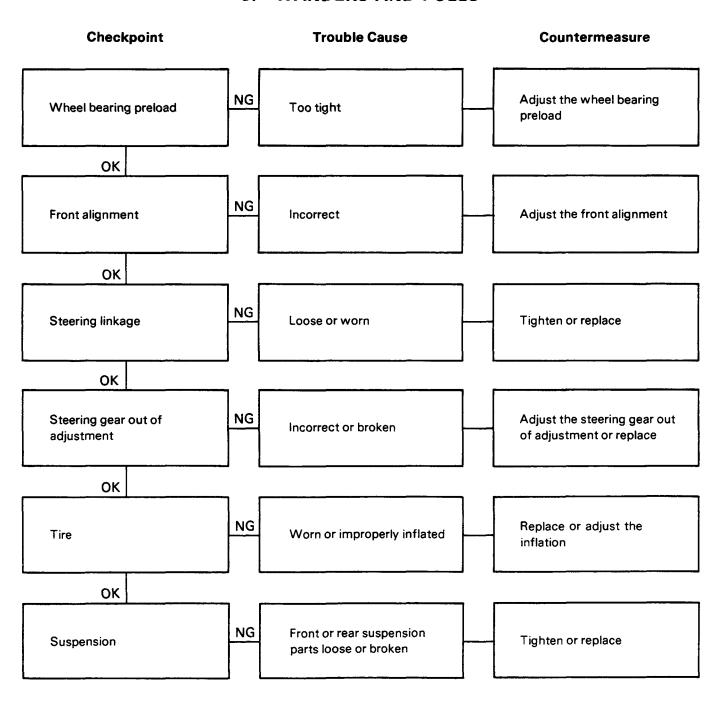
# 3. NOISES IN FRONT AXLE DRIVE SHAFT JOINT



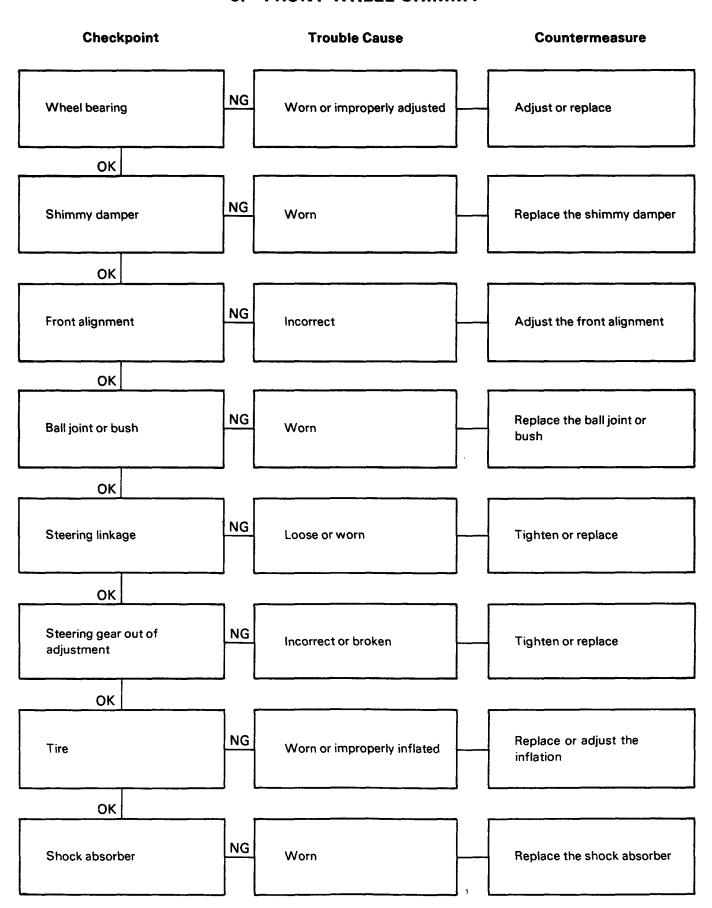
# 4. NOISES IN FRONT AXLE



# 5. WANDERS AND PULLS



# 6. FRONT WHEEL SHIMMY

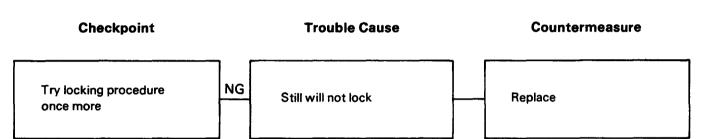


# 7. AUTOMATIC LOCKING FREE WHEEL HUB

#### (1) DOES NOT LOCK OR LOCKS ONLY ON ONE SIDE

#### Note:

- 1. Stop the vehicle
- 2. Shift the transfer lever to 4H or 4L
- 3. Now start driving the vehicle and the hubs will lock automatically.
- 4. Once the hubs are locked, they will remain locked, even if the transfer lever is shifted from 4L or 4H into 2H, as long as the vehicle travels in a same direction.

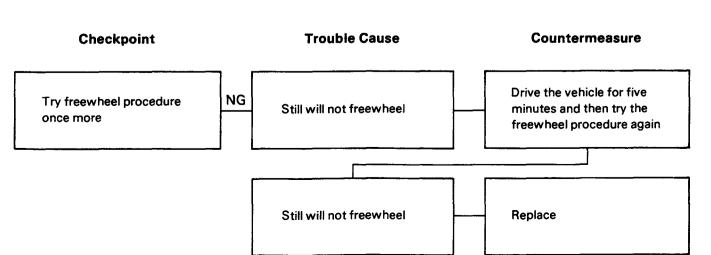


#### (2) DOES NOT FREEWHEEL OR FREEWHEELS ONLY TO ONE SIDE

#### Note:

#### Freewheel operation

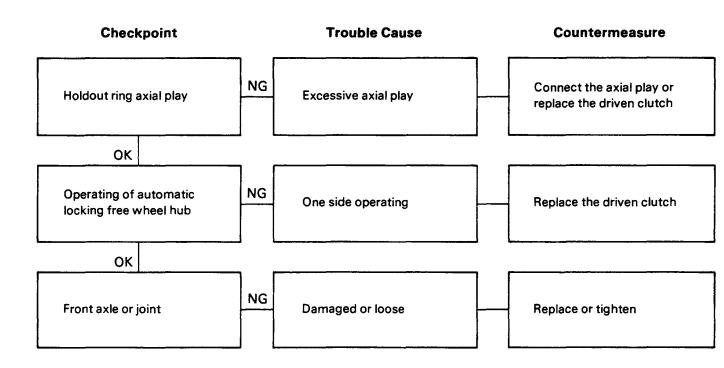
- 1. Stop the vehicle
- 2. Shift the transfer lever to 2H
- 3. Back up the vehicle for three or four feet; this will disengage the front differential.



#### (3) NOISES IN AUTOMATIC LOCKING FREE WHEEL HUB

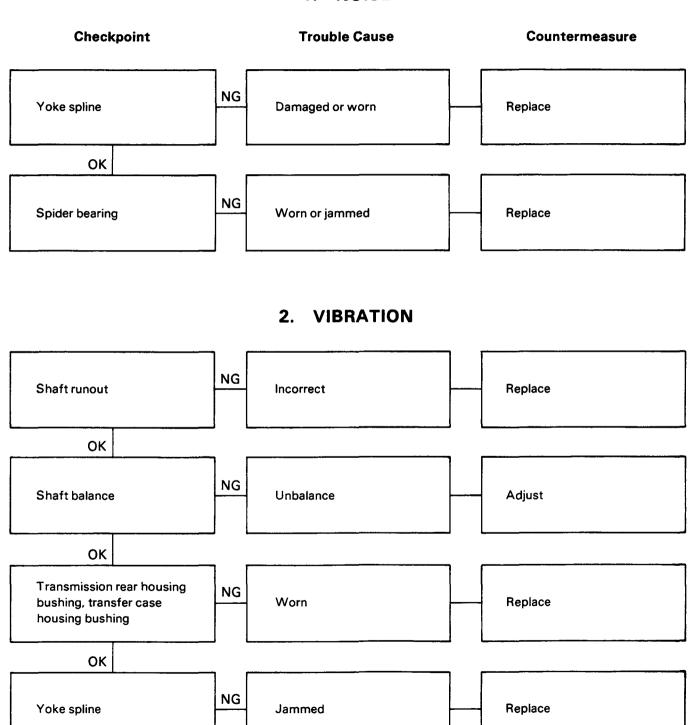
#### Note:

Some noise at the time of shifting from "LOCK" to "FREE" or vice versa is normal. It is not a sign of trouble.



#### **PROPELLER SHAFT**

#### 1. NOISE



# ISUZU<br/>KB - SERIES

# **WORKSHOP MANUAL**

**SECTION 4E** 

DIFFERENTIAL LOCKING DEVICE

PAGE

#### **SECTION 4E**

# DIFFERENTIAL LOCKING DEVICE (MODEL 77/82)

#### **TABLE OF CONTENTS**

Description and operating principle	4E – 2
Electrical circuit	4E – 2
Pneumatic circuit	4E - 2
Diff lock actuation	4E - 3
Servicing	4E – 3
Diff lock malfunction	
Fault diagnosis	
Repair of cover assembly	
Failure off diff lock or axle components	
Oil leak at diaphragm	
Failure of mechanical components	
Exploded view of diff lock component assembly	
Electrical control system diagram	
Pneumatic control system	
Setting yoke "Off" position checking between pins	
Setting the switch spring position	

#### **DESCRIPTION AND OPERATING PRINCIPLE**

The Model 77 and Model 82 diff locks are a family of electrically engaged, vacuum actuated differential locks for rear axles.

The axles are identified by the I.D. tag on the underside of the axle carrier which will show the model (77 or 82) followed by eight serial number digits.

Components of the diff housing and coupling assembly and the cover assembly are shown in Fig. 1.

Schematic diagrams of the Pneumatic and Electrical Control System are shown in Fig. 2.

#### **ELECTRIC CIRCUIT**

Closing the dashboard switch (on) will energise the red 'on' light and the control valve. When the diff actually locks, the green 'Locked' lights circuit is earthed via the axle switch, thus energising the 'locked' light.

When the dashboard switch is opened (off), the 'on' light and control valve are de-energised. The 'locked' light will however remain on until the diff actually unlocks, causing the earth connection to be broken via the axle switch.

#### PNEUMATIC SYSTEM

With the engine running, vacuum is built up in the front hose from a T-piece connection to the brake booster hose. This vacuum is maintained in the front hose by the non-return valve and the 'closed' control valve.

When the control valve is energised (see ELECTRICAL CIRCUIT) it connects the front hose to the rear hose and the diaphragm rear chamber, creating a vacuum in the latter. The front hose acts as an accumulator as well as a hose. When the control valve is de-energised, it closes the connection to the front hose and connects the rear hose to atmosphere. This allows the vacuum in the diaphragm rear chamber to be released.

#### **DIFF LOCK ACTUATION**

When vacuum is applied to the diaphragm rear chamber, it pulls the yoke screw and yoke rearward. This causes the coupling to be forced to the left via the yoke pins. The coupling teeth are permanently engaged with the slots in the diff housing but can slide left and right in these slots to engage/disengage with the side gear lock tooth slots.

When the coupling teeth align with the lock tooth slots in the side gear, the coupling will slide fully into engagement with the side gear. The coupling then prevents relative movement between diff housing and side gear, causing the whole diff train and both axle shafts to rotate as a unit, i.e. locked.

When the vacuum in the rear diaphragm chamber is released the yoke return spring forces the coupling to the left and out of engagement with the side gear. This occurs as soon as any torque between side gear and coupling is released.

When the coupling is fully engaged with the side gear, the diaphragm assembly moves fully rearward, causing its metal part to contact the switch spring.

This earths the switch spring via the various metal components of the axle which are in electrical contact with the vehicle earth.

When the coupling is dis-engaged, contact between the switch spring and diaphragm metal is broken and the 'locked' light circuit is then incomplete.

#### SERVICING

The only requirements for servicing are:-

- · the diff lock does not function properly, or
- there is failure of one or more diff lock axle components.

#### **DIFF LOCK MALFUNCTION**

Test the diff lock function as follows:-

- Jack both rear wheels off the ground.
   Warning: Do not test diff lock with only ONE rear wheel jacked. It could drive the vehicle off the jack.
- 2. Place gearbox in neutral and start the engine to generate vacuum.
- With engine idling, switch the diff lock on. The red indicator light should be on. The green light can be on or off.

- . Rotate one rear wheel forward by hand until the diff lock engages. This should be audible and the opposite wheel should also rotate forward. The green light should now be on.
- Switch the diff lock off and then rotate one rear wheel slightly backwards and forwards until the diff lock disengages. When one rear wheel is turned forward the opposite rear wheel should now turn backwards. Both lights should now be off.
- 6. If these checks are OK, the diff lock functions correctly.
- 7. A road test can also be conducted by switching the diff lock on whilst cornering at low speed (even on tar if the vehicle is not loaded). The diff lock is engaged when the green light comes on and the rear tyres chirp on the road.

Switch the diff lock off and steer very slightly left and right until the diff lock disengages.

If the diff lock does not function correctly, follow the fault diagnosis charts A to D in the next section.

#### **FAULT DIAGNOSIS**

A. Diff lock does not engage
With engine idling and diff lock on, check in sequence:-

PRIMARY CHECK		SECONDARY CHECKS OR ACTION
Is red light on?	YES	<ul> <li>Fuse</li> <li>Power at switch terminals (f) and (g) (Fig. 2A).</li> <li>Power connection (a). Is it 12V?</li> <li>Faulty switch.</li> <li>Faulty red LED.</li> </ul>
Is there power at control valve red/white lead (b) (Fig. 2A)?	NO YES	- Break in red/white lead.
Does valve 'click' when diff lock is switched on-off-on?	NO YES	- Brown lead (d) earthed? - Faulty control valve (replace).
Is there vacuum in thick hose at (s) (Fig. 2B)?	NO YES	<ul> <li>Non-return valve hose connections reversed nylon (Fig. 2B).</li> <li>Blockage in hose from manifold to valve - trace upstream.</li> </ul>
With hose re-connected at (s) and valve still energised, is there vacuum at valve pipe (t) (Fig. 2B)?	NO YES	- Faulty valve (replace).
With hose re-connected at (t), is there vacuum is applied at (v)?	NO YES	- Blockage or kink in thin nylon hose between valve and axle
Remove axle cover. Does yoke move left when vacuum is applied at (v)?	NO YES	- Faulty cover assembly. See REPAIR OF REAR COVER.
Does coupling slide freely left and right when side gear slots are aligned (rotate one wheel to align)?	NO YES	<ul> <li>Faulty diff housing assy.</li> <li>(Correct cause of sticking or replace diff housing assy complete).</li> </ul>
Replace cover assy. Make sure both yoke pins engage in coupling slot. Re-check diff lock engagement.	NO	- Contact manufacturers.

#### FAULT DIAGNOSIS (CONT.)

B. Diff lock does not disengage
With engine idling and diff lock switched off, check in sequence:-

PRIMARY CHECK		SECONDARY CHECKS OR ACTION
Is red light off?	NO	<ul><li>Faulty switch replace.</li><li>Short circuit from red power lead (a) to red/</li></ul>
	YES	white lead (g).
Power at control valve red/white lead?	YES	- Short circuit from red power lead to red/white lead.
Correct control valve connections? (Thick hose to centre pipe marked "VACUUM". Thin hose to outer pipe - Fig. 2B).	NO	- Correct the connections.
Diff lock disengages when thin nylon pipe is disconnected from control valve?	YES	- Faulty control valve (replace).
Diff lock disengages when vacuum pipe is disconnected from axle at (v), (Fig. 2B)?	YES	- Blockage or kink in thin nylon hose from valve to axle.
Are yoke pins correctly located in coupling groove? Remove cover carefully to check	NO YES	- Re-assembly cover correctly.
Does yoke spring back to the right when vacuum is disconnected.	NO YES	- Faulty cover assembly. See REAR OF COVER ASSEMBLY.
Does coupling slide freely to the right.	NO YES	<ul> <li>Faulty diff housing assy.</li> <li>(Correct cause of sticking or replace diff housing assy complete).</li> <li>Contact manufacturers.</li> </ul>

#### **FAULT DIAGNOSIS (CONT.)**

C. Green light does not illuminate when diff lock is locked With diff lock on and locked, check in sequence:-

ζ

#### SECONDARY CHECKS OR ACTION PRIMARY CHECK NO - Faulty LED> Does green light illuminate - Break in black wire from LED to axle. when terminal (e) at axle YES - No power supply to LED. is earthed to chassis? (Fig. 2A). Does green light illuminate YES - Fit earth wire from any place on when aluminium cover is axle to a chassis - Faulty cover assy. NO earthed to chassis. See REPAIR OF COVER ASSEMBLY.

#### D. Axle does not drive vehicle

#### PRIMARY CHECK

Do the axle shafts have 27 tooth splines?

NO YES

- SECONDARY CHECKS OR ACTION
- Replace with correct 27 tooth axle shaft splines.
   Contact manufacturers
- Contact manufacturers.

#### REPAIR OF COVER ASSEMBLY

If the fault has been traced to the cover assembly, remove it from the rear axle and repair it according to the fault.

After repairing the cover assembly, re-assemble it to the axle, making sure that the yoke pins engage in the coupling groove.

Fault from diagnosis chart A i.e. with vacuum applied to pipe (V), yoke does not move to the left.

#### a) Sticking yoke

- Move the yoke to the left by hand, check that it moves freely and returns freely via the return spring.
- If not, locate the cause of sticking and correct it. Replace faulty parts when necessary.
- Check for excessive wear on the yoke pins. Replace the yoke if necessary.
- If it is necessary to remove the shaft-yoke to cover, drill a hole in the expansion plug which retains the shaft and lever the plug out.
  - Take care not to damage the aluminium cover
  - Apply silicone sealer to the new expansion plug before expanding it into place with a flat faced punch and medium hammer blow.

#### REPAIR OF COVER ASSEMBLY

#### Fault from diagnosis chart A (cont'd)

#### b) Leaking diaphragm

If the fault is an air leak (or oil leak), replace the diaphragm.

- 1. Remove the plastic diaphragm cover.
- Remove the diaphragm from the yoke screw and replace it.
  - Earlier models have two washers and a self-locking nut to retain the diaphragm.
     Later models have a integral diaphragm and washer assembly (see Fig. 1).
     Be sure to re-assembly in the correct sequence (Fig. 1).
  - If replacing the older type diaphragm and separate washers with the new type integral diaphragm and washer assembly, then the spring-yoke to diaphragm must also be replaced with 06-00-156-010 and screw-yoke to diaphragm with 06-00-183-037.

# 3. Adjust the yoke 'off' position with the aid of Gearmax Special Tool Number 5397-6205 as follows:-

- Bolt the special tool to the cover as shown in Fig. 3.
   Tighten the nuts.
- Restrain the diaphragm washer assy (or rear washer and nut assy on older models) by holding it with a spanner.
- Get an assistant to push the diaphragm and washer assembly forward (i.e. hold it firmly against the aluminium cover).
- Adjust the yoke screw with an Allan key so that there is a gap of 0,4 mm between the yoke pins and the stops on the special tool. Measure with a feeler gauge.
- On the older design, get the assistant to apply a drop of Locktite 242 (or equivalent) to the end of the screw and tighten the self-locking nut to a torque of 2,0 to 3,0 Nm. (The new type does not require a lock-nut).
- With the yoke held in its off position by the return spring, check that there is a gap of zero to 0,8 mm between the yoke pins and the stops on the special tool.

- The special tool is also designed to check that the yoke pins are the correct distance apart. There should be a gap of 0,10 to 0,50 mm between one end of one pin and the tool when the outer pin end is in contact with the tool (Fig. 3). The yoke can slide on the shaft to achieve this. Bend the yoke if necessary.
- Check the switch spring position adjustment as per Fig. 4 and re-assembly the diaphragm cover assembly to the aluminium cover assembly. Torque the six M4 screws to 1,5 to 1,9 Nm.

#### REPAIR OF COVER ASSEMBLY (CONT'D)

# Fault from diagnosis chart B i.e. Yoke does not spring back to the right when vacuum is disconnected.

This could be due to the return spring being weak or broken or the yoke sticking for some reason.

In either event, remote the shaft-yoke to cover as described and replace the return spring or correct the cause of sticking. If the yoke to diaphragm screw setting is disturbed, re-set.

# Fault from diagnosis chart C i.e. green light does not illuminate when diff-lock is on and locked.

- Remove the plastic diaphragm cover assy. Check that the switch spring is not broken and that the diaphragm washer and switch spring are clean.
- Check, and if necessary, adjust the position of the end of the switch spring as shown in Figure 4.
- Confirm that there is electrical contact between the switch spring and the external mounting terminal to which it is screwed or pop-rivetted. If not, correct the problem or replace the diaphragm cover assembly.
- Re-assemble the diaphragm cover assembly to the Aluminium cover assembly. Torque the six screws to 1,5 to 1,9 Nm.
- 5. If the fault persists, the yoke 'off' position setting is suspect.

# FAILURE OF DIFF LOCK OR AXLE COMPONENTS OIL LEAK AT DIAPHRAGM

First tighten the six screws holding the plastic cover to 1,5 to 1,9 Nm. If this does not cure the problem, replace the diaphragm.

#### FAILURE OF MECHANICAL COMPONENTS

Replace failed or damaged components as required. Check the following items when re-assembling:-

With the ring gear bolted to the assembled diff housing, the side gears must be able to rotate freely.

- 1. Rotate the side gears so that the lock tooth slots are aligned with the slots in the RH diff housing.
- 2. Stand the diff housing assembly vertical i.e. ring gear teeth facing up.

#### FAILURE OF MECHANICAL COMPONENTS (CONT'D)

- . Fit the coupling with the groove towards the ring gear.
- The coupling must be able to slide freely under its own weight to fully engage with the side tooth slots. Remove any dirt or burrs or replace parts if necessary.

Set up diff break-away and backlash as per the main section of the Gearmax Service Manual, 1990 Edition.

#### **EXPLODED VIEW OF DIFF LOCK COMPONENT ASSEMBLY**

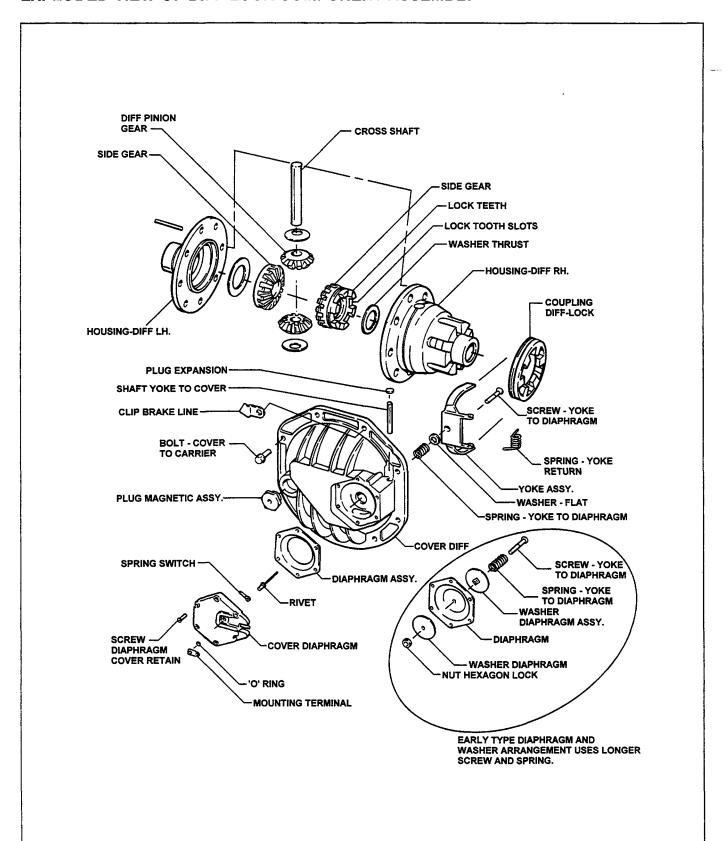


Figure 1

#### **ELECTRICAL CONTROL SYSTEM**

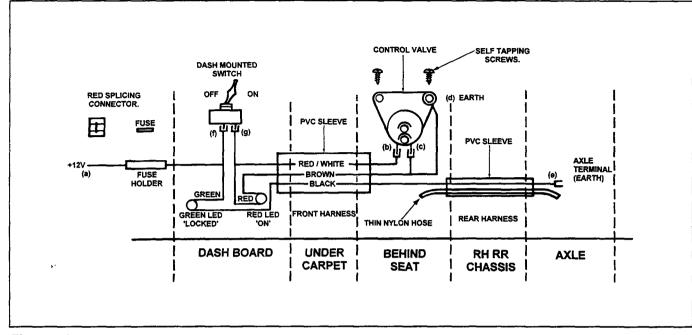


Figure 2A

#### PNEUMATIC CONTROL SYSTEM

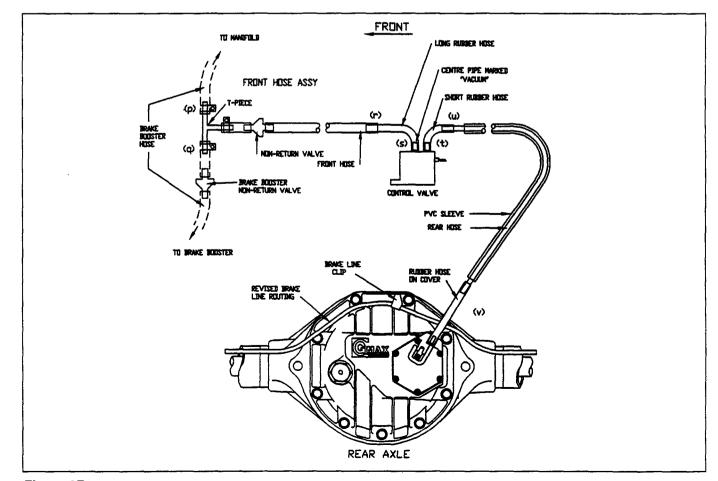
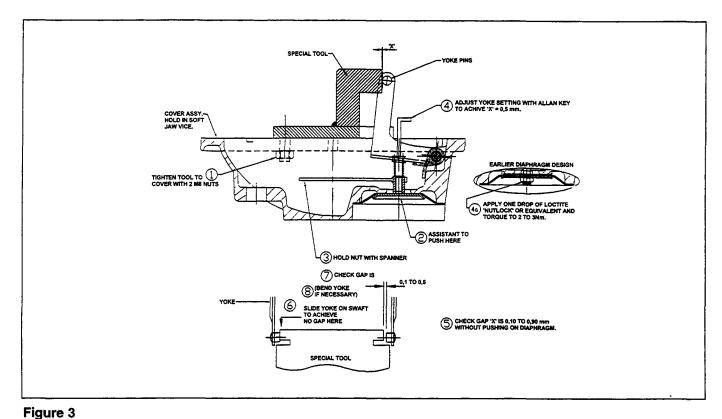


Figure 2B

#### SETTING YOKE 'OFF' POSITION AND CHECKING BETWEEN PINS DIMENSIONS



SETTING THE SWITCH SPRING POSITION

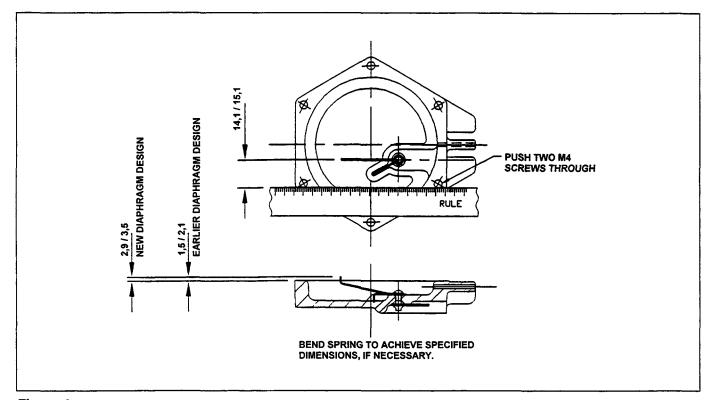


Figure 4











Front Brakes

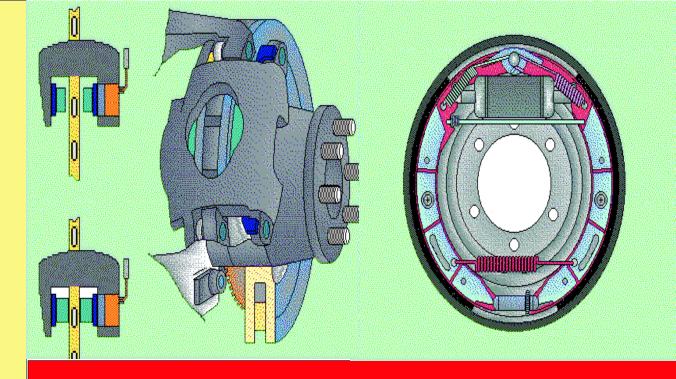
Rear Brakes

Master Cyl.

Vacuum

Park Brake

Servicing



# KB TF 140 Brakes



# SECTION 5 BRAKES

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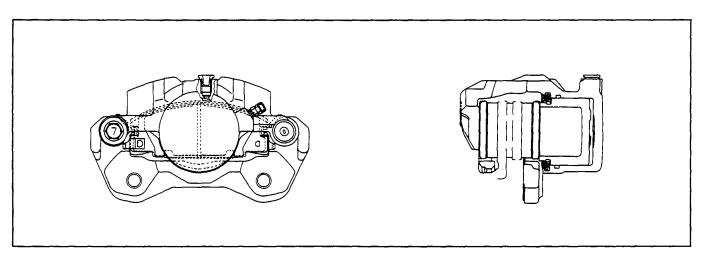
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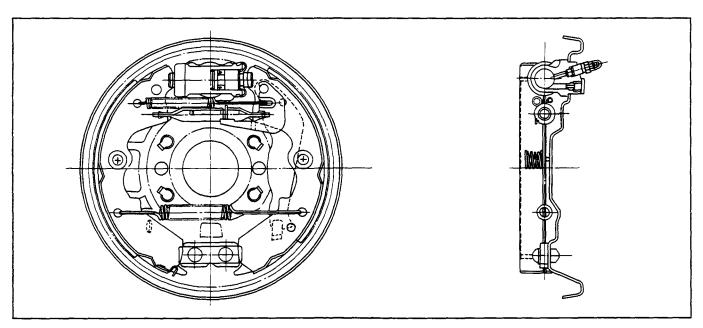
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# GENERAL DESCRIPTION

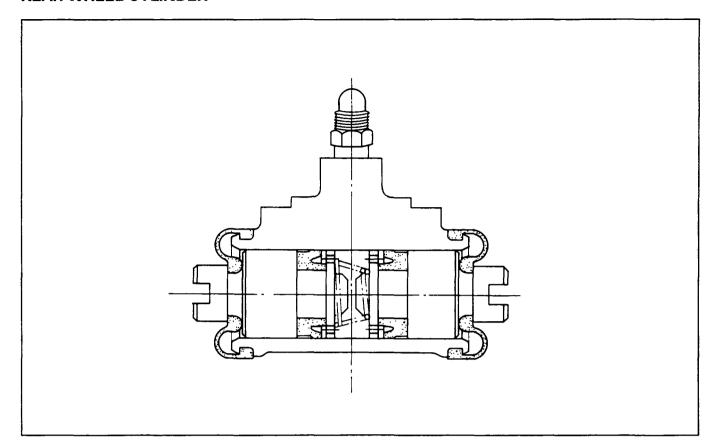
#### FRONT DISC BRAKE



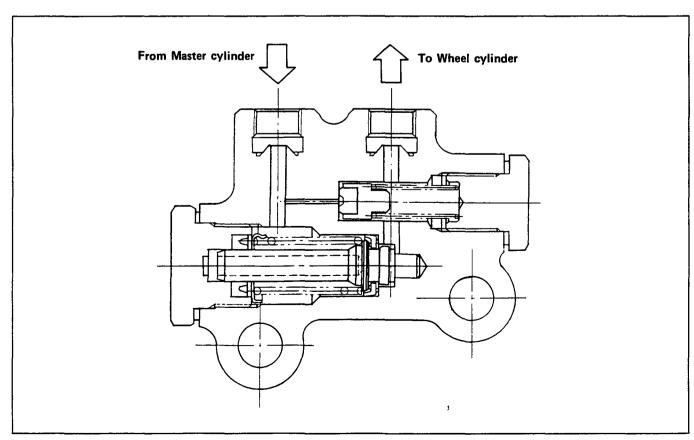
#### **REAR DRUM BRAKE**



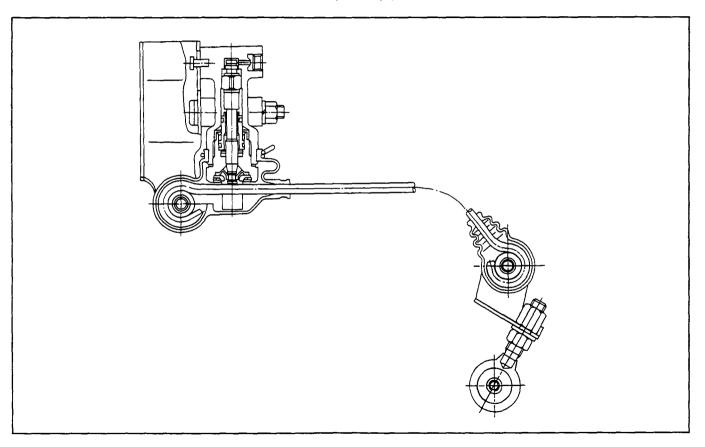
#### **REAR WHEEL CYLINDER**



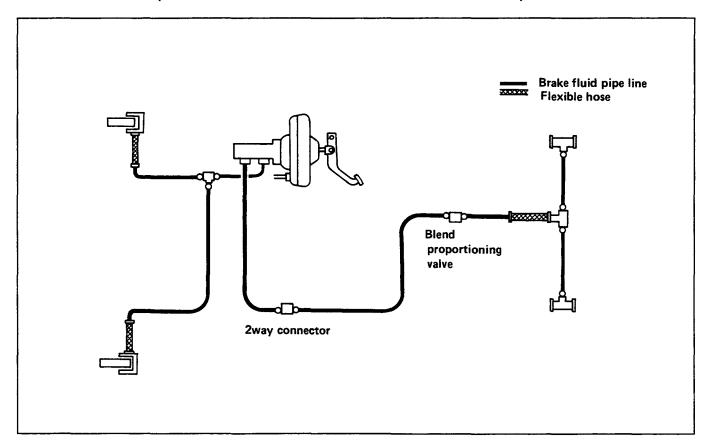
#### **BLEND PROPORTIONING VALVE (EXCEPT FOR EUROPE AND SOUTH AFRICA)**



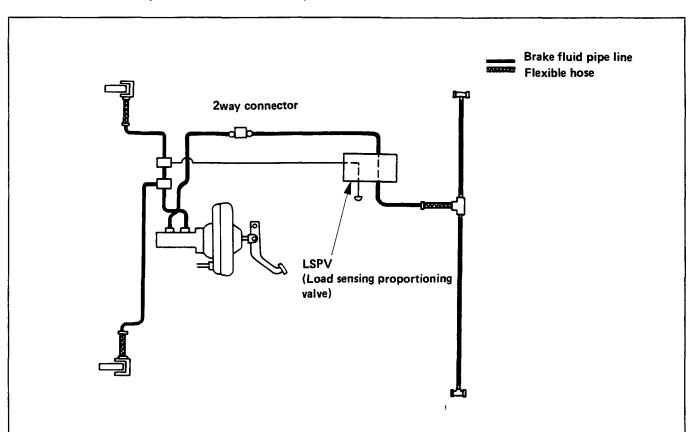
## LOAD SENSING PROPORTIONING VALVE (LSPV) (FOR EUROPE AND SOUTH AFRICA)



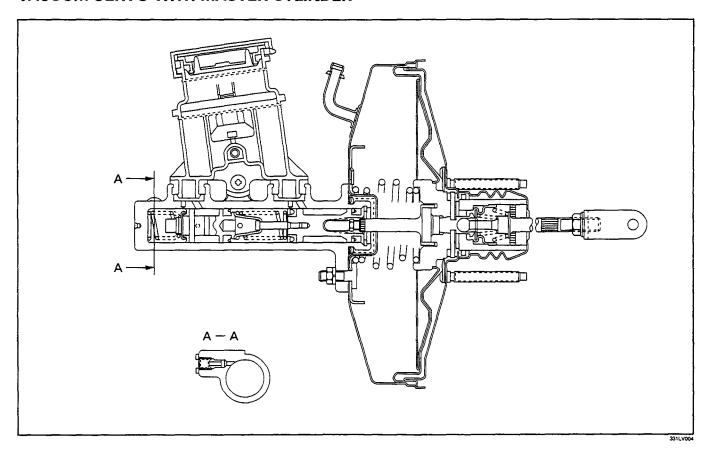
#### PIPING DIAGRAM (MODEL WITH BLEND PROPORTIONING VALVE)



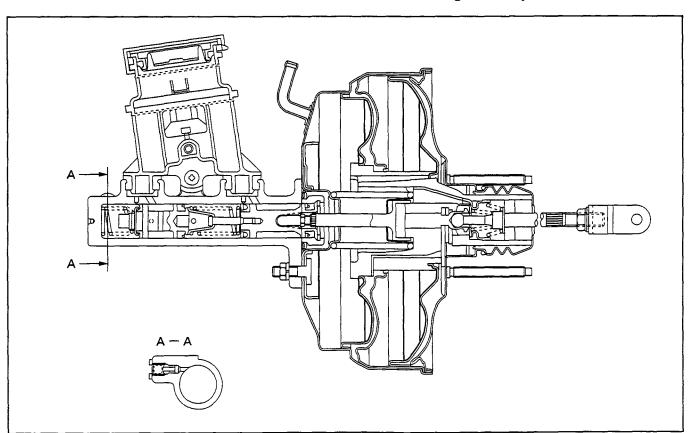
#### **PIPING DIAGRAM (MODEL WITH LSPV)**



## VACUUM SERVO WITH MASTER CYLINDER



#### VACUUM SERVO WITH MASTER CYLINDER (2.6L (4ZE1 engine) only Australia)



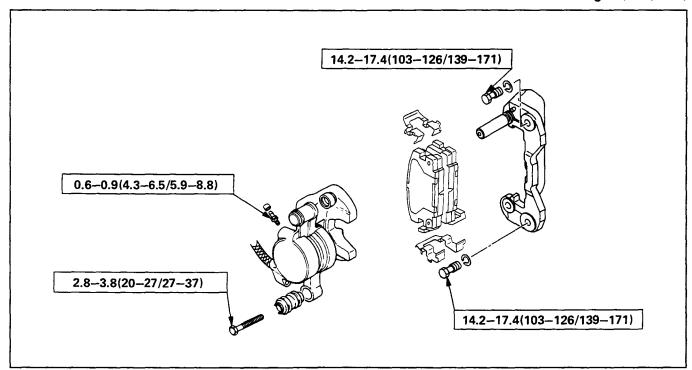
### MAIN DATA AND SPECIFICATIONS

FRONT DISC BRAKE	mm(in.)		
Caliper type		Pin	slide
Disc outside diameter		257 (10.118)	
Disc thickness		22 (0.866)	
Piston diameter		60.33 (2.375)	
Adjustment method		Self-adjusting	
REAR DRUM BRAKE	mm(in.)	4 x 2	4 × 4
Туре		Leading and Trailing	
Drum inside diameter		254 (10.008)	295 (11.614)
Brake lining dimension		221 x 50 x 5	283 x 45 x 4
(Length x Width x Thickness)		(8.71 x 1.97 x 0.20)	$(11.14 \times 1.77 \times 0.16)$
Adjustment method		Self-adjusting	
WHEEL CYLINDER	mm(in.)		
Inside diameter : rear			
Europe and South Africa		25.40 (1.000)	
Others		22.22 (0.875)	
MASTER CYLINDER	mm(in.)		
Туре		Split	
Bore diameter		23.81 (0.938)	
Piston stroke (Primary + Secondary)		19 + 12 (0.75 + 0.47)	
VACUUM SERVO	mm(in.)		
Diaphragm diameter			
Except 2.6L (4ZE1 engine) Australia		230 (9.055)	
2.6L (4ZE1 engine) only Australia		180 (7.087) + 205 (8.077)	
Power cylinder stroke		32.5 (	1.281)
PEDAL RATIO		4.	04
BALANCE			
Туре		Blend propor	tioning valve/
		<u> </u>	oportioning valve
		(For Europe, South Af	rica and Saudi Arabia)
		<u> </u>	

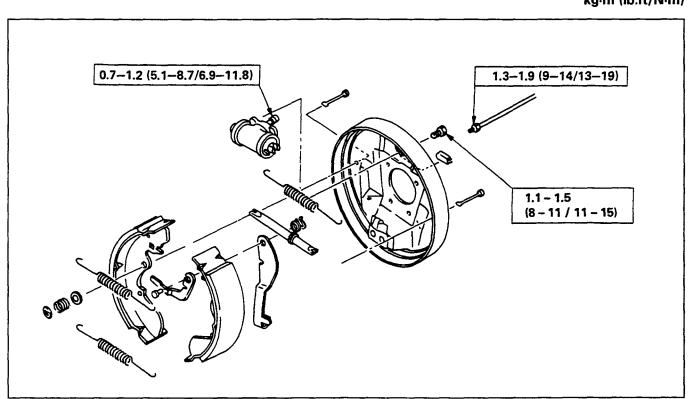
# SPECIAL PARTS FIXING NUT AND BOLT

#### FRONT WHEEL BRAKE

kg·m (lb.ft/N·m)

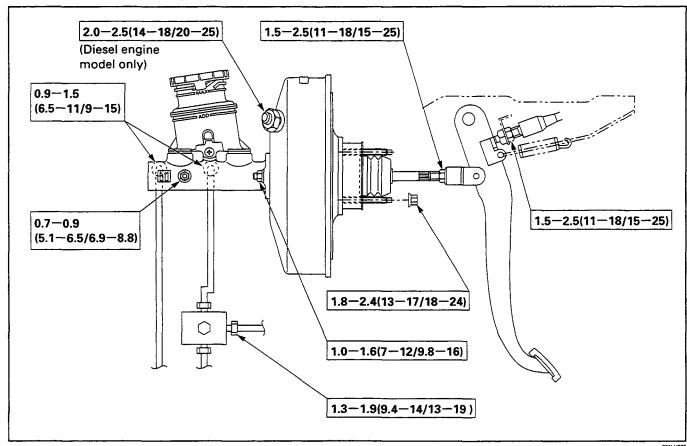


#### **REAR WHEEL DRUM BRAKE**



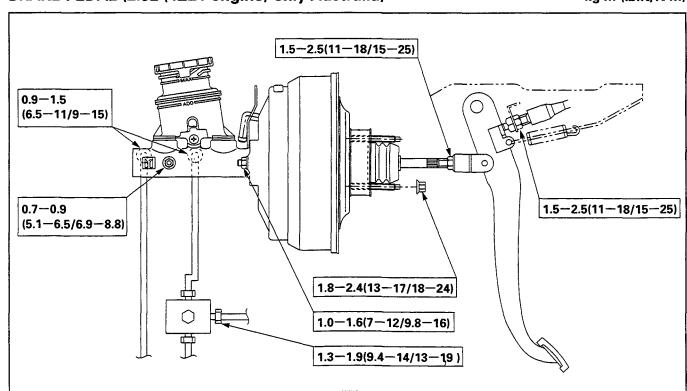
# VACUUM SERVO WITH MASTER CYLINDER AND BRAKE PEDAL (Except 2.6L (4ZE1 engine) Australia)

kg·m (lb.ft/N·m)



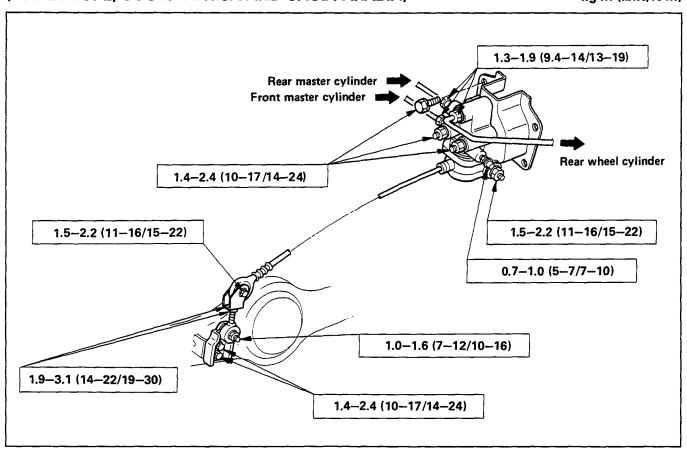
#### 331LV00

# VACUUM SERVO WITH MASTER CYLINDER AND BRAKE PEDAL (2.6L (4ZE1 engine) only Australia)

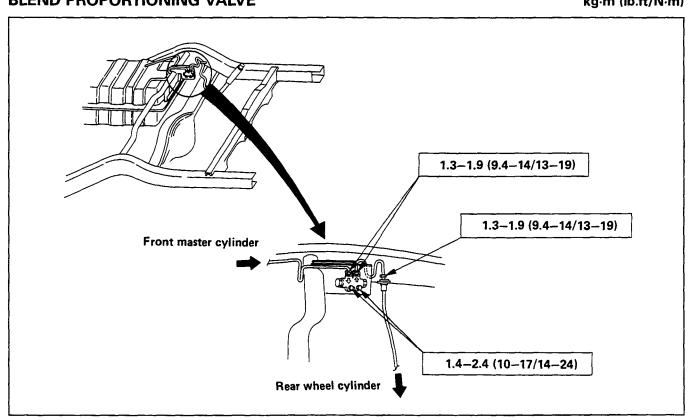


#### LOAD SENSING PROPORTIONING VALVE (FOR EUROPE, SOUTH AFRICA AND SAUDI ARABIA)

kg·m (lb.ft/N·m)

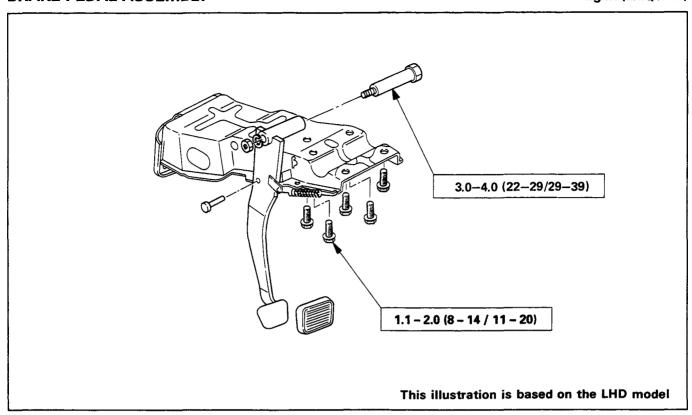


#### **BLEND PROPORTIONING VALVE**

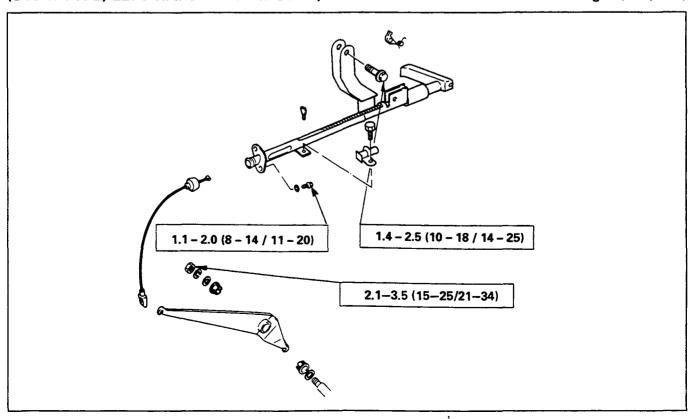


#### **BRAKE PEDAL ASSEMBLY**

kg·m (lb.ft/N·m)

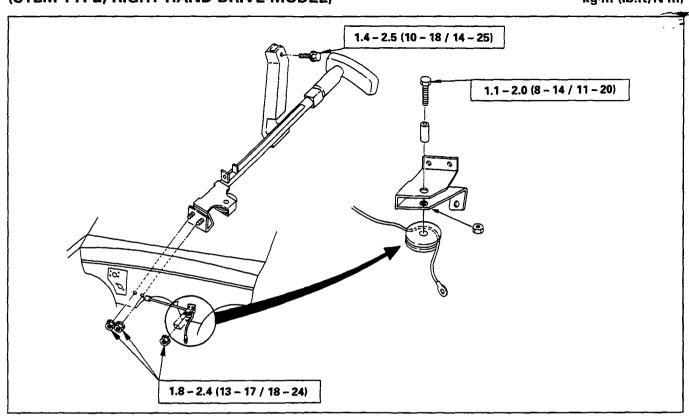


# PARKING BRAKE STEM ASSEMBLY (STEM TYPE, LEFT HAND DRIVE MODEL)

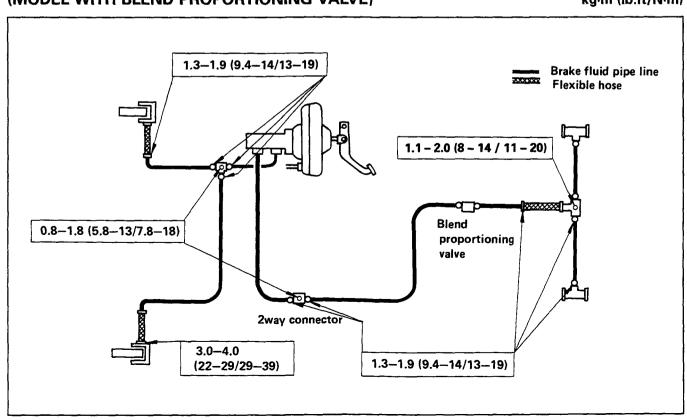


# PARKING BRAKE STEM ASSEMBLY (STEM TYPE, RIGHT HAND DRIVE MODEL)

kg·m (lb.ft/N·m)

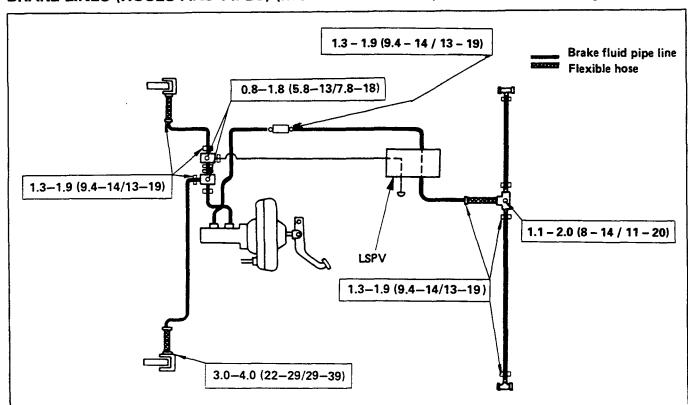


# BRAKE LINES (HOSES AND PIPES) (MODEL WITH BLEND PROPORTIONING VALVE)

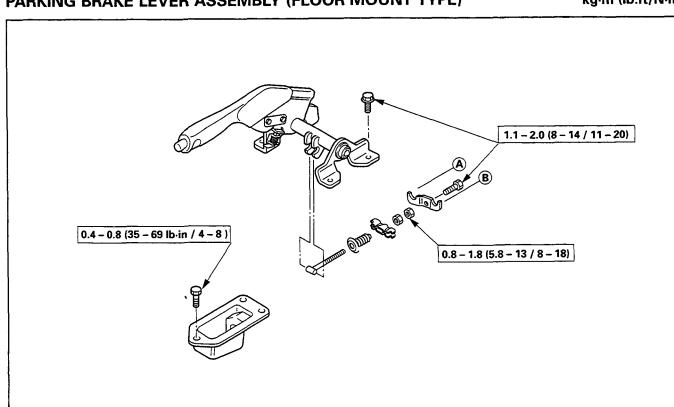


#### BRAKE LINES (HOSES AND PIPES) (MODEL WITH LSPV)

kg·m (lb.ft/N·m)



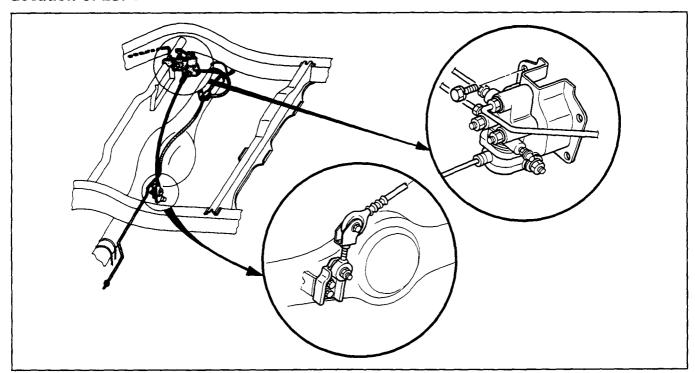
#### PARKING BRAKE LEVER ASSEMBLY (FLOOR MOUNT TYPE)



#### **SERVICING**

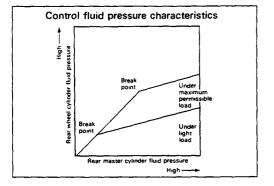
# LOAD SENSING PROPORTIONING VALVE (LSPV) (FOR EUROPE, SOUTH AFRICA AND SAUDI ARABIA)

#### **Location of LSPV**



#### **Structure and Operation**

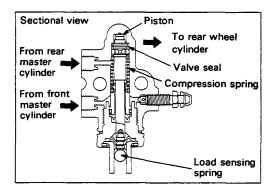
The following is an explanation of the structure and operation of the linkage type load sensing device. This device controls the fluid pressure to the rear brakes in accordance with changes in rear axle load (vertical displacements of the rear axle springs).

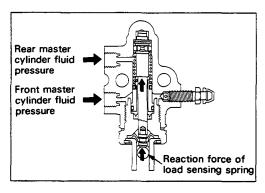


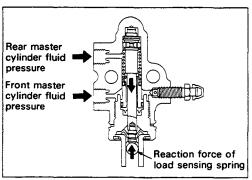
#### Structure

This device consists of a load sensing spring (bending bar) and a valve.

The valve is mounted through a bracket to the frame. One end of the load sensing spring is fixed to the valve at the frame and the other end to the rear axle housing through a shackle.







#### Operation

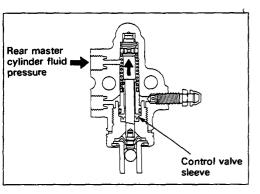
#### 1) Outline

When the L.S.P.V. (Load Sensing Proportioning Valve) detects a change in load weight, the load sensing spring deflects. Its reaction force is transmitted to the bottom of the load sensing valve to secure an optimum rear wheel cylinder fluid pressure break point in proportion to the actual load weight.

Besides, if the front brake system should fail, the device is designed to prevent the master cylinder fluid pressure from decreasing and to apply it directly to the rear wheel cylinder to obtain a sufficient braking performance.

#### 2) Operation

- (1) When the fluid pressure is under the break point. The fluid pressure of the rear master cylinder passes through a clearance between the valve seal and the piston and acts on the rear wheel cylinder. At this moment, a downward force is applied to the piston. However, the compression spring force and reaction force of the load sensing spring keep the piston in the upper position by pushing upwards (See the left figure.)
- (2) When the fluid pressure is equal to the break point. As the rear wheel cylinder pressure increases, it surpasses the compression spring force and reaction force of the load sensing spring, causing the piston to move downwards, so that the piston butts against the valve seal to shut off the fluid line between the master cylinder and rear wheel cylinder. (See the left figure.)
- (3) When the fluid pressure is over the break point. When the fluid pressure increases further, the piston moves upwards. The moment the piston comes apart from the valve seal, fluid pressure is applied to the rear wheel cylinder and the piston moves downwards so that the fluid line is shut off again. This process goes on repeatedly to control the fluid pressure to the rear wheel cylinder.



(4) When the front brake system fails.

When there is a failure in the front brake system, the fluid pressure from the front master cylinder decreases. As a result, the balance between the front and rear brake side fluid pressures is lost at the control valve sleeve so that the control valve sleeve moves upwards.

The control valve sleeve strikes against the piston, thereby pushing the piston upwards. Accordingly, the fluid pressure of the rear master cylinder is not decreased and is applied directly to the rear wheel cylinder to secure a sufficient braking performance of the rear brakes. (See the left figure.)

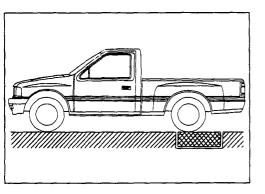


#### **Valve Maintenance**

In the case of fluid leak or other abnormalities, faulty valve should be replaced.

#### Note:

The load sensing proportioning valve is not repairable and must be replaced as a completed assembly.





# ADJUSTMENT PROCEDURE OF LSPV (FOR EUROPE AND SOUTH AFRICA)

This adjustment should be performed with the battery voltage applied to the valve.

1. Adjust the rear axle weight by loading the rear body as necessary.

Rear axle weight

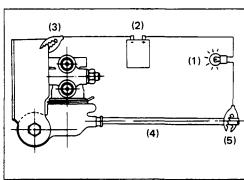
kg (lbs)

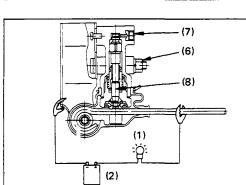
650 (1,433)

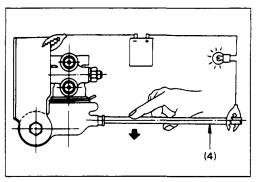
#### Note:

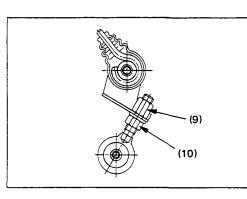
The rear axle weight should be adjusted to the specified value with a man seated in the driver seat.

#### 5 - 18 BRAKES









2. Connect the wiring with miniature lamp (1) and a battery (2) between valve bracket (3) and linkage (4) with each end of wiring clipped. This wiring is necessary to find the moment at which piston within the valve assembly is brought into connect with the

linkage.

Note:

As the linkage is coated with insulation material, turn the

clip (5) with 2 or 3 turns to break insulation.

3. Loosen the nut (6) and raise the valve assembly (7) all

1.7 (12/17)

outlined under paragraph 3. Excessive force is exerted on linkage by piston (8) within

the valve assembly.

the way. Then lower the valve assembly gradually and tighten the nut (6) when miniature lamp (1) turns on. kg·m(lb.ft/N·m) Torque

Note:

If the miniature lamp (1) goes out as the nut (6) is

tightened, lower the valve assembly (7) slightly with the

nut loosened, then retighten the nut (6).

4. Depress the linkage (4) near the valve assembly slightly downward with finger (test pressure: 0.5 - 0.8 kg) and

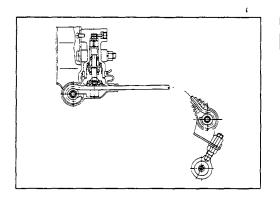
check to see if the miniature lamp (1) goes out. Lamp goes out: OK Adjustment is completed. Lamp remains on : NG Repeat adjustment operation

Note:

Adjustment can also be made by means of nuts (9) and (10)

on shackle at rear axle case side. However, shackle nut is adjustment.

not normally used for adjustment as it is for making fine



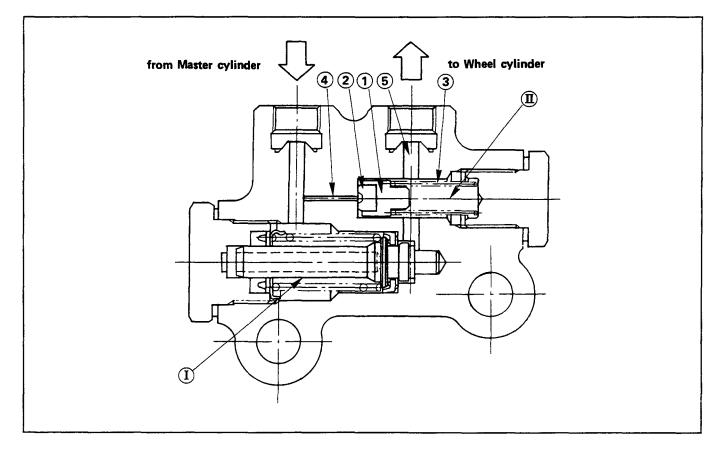


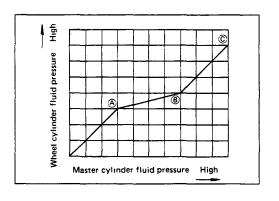
- 5. Inspection of brake fluid pressure (Reference value)
  - Adjust the rear axle weight as specified under the paragraph 1.
  - 2) Install the pressure gauge on bleeder screws on the front and rear brakes.
  - 3) Depress the brake pedal and take reading of the pressure gauges. The brake fluid pressure is normal if the pressure of fluid within the rear wheel cylinders is within the range of 34.4 ±5.5 kg/cm<sup>2</sup> when pressure of fluid within the front wheel cylinders reaches 50 kg/cm<sup>2</sup>.

#### Note:

The brake pedal should be depressed gradually until specified pressure is reached without pumping or adjusting foot pressure.

### **BLEND PROPORTIONING VALVE (IF SO EQUIPPED)**





#### **Structure and Operation**

Structure

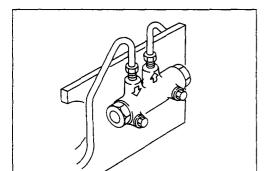
Side ① shows P-valve; side ① shows bypass valve. Bypass valve seals the routes ④ and ⑤ using the seal ② at the piston ① end. In addition, spring ③ presses against the piston ①, and in order to seal out the route ④ and route ⑤ sufficiently, spring ③ presses seal ② against cylinder end surface. The left figure is a characteristic curve diagram.

#### Operation

The operation of the P-valve by the master cylinder pressure is unchanged up to the brake points (A) and (B). If master cylinder fluid pressure penetrates into the second break point (B), the fluid pressure pressing against the seal (2), (which isolated route (4) and route (5)), passing the route (4) of the master cylinder side, overcomes the operating force of the spring (3) + fluid pressure affecting the seal (2) of the wheel cylinder, and presses the piston (1) to the right side, resulting in the opening of the routes (4) and (5), and canceling of the P-valve operation.

Then, because the master cylinder fluid pressure and the wheel cylinder fluid pressure, up to the point ©, operate on the identical surface of the seal ②, both have identical ascending ratio.

However, because of the operation of spring ③ in the wheel cylinder side, wheel cylinder fluid pressure operate to preserve the balance against the master cylinder fluid pressure on the lower level with the difference in pressure resulting from this spring.





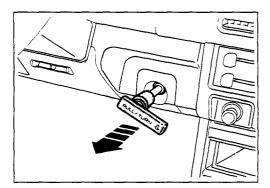
#### Valve Maintenance

In the case of fluid leak or other abnormalities, faulty valve should be replaced.

The valve is set up at the right hand side of the 5th crossmember near the rear axle.

#### Note:

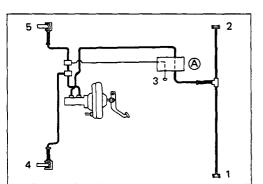
The blend proportioning valve is not repairable and must be replaced as a complete assembly.

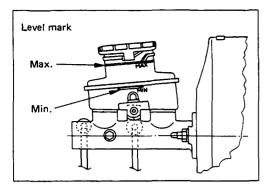


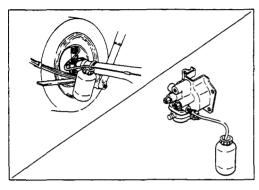
#### **BLEEDING OF THE BRAKE HYDRAULIC CIRCUIT**

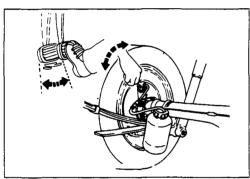
If air enters the brake lines, it will cause poor brake action. Therefore, bleeding should be performed if the brakes have been used with the level of brake fluid in the reservoir excessively low or if brake pipes have been disconnected in the course of brake servicing. Bleeding operation calls for co-operative action of 2 persons.

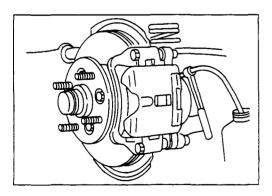
- Set the parking brake firmly while bleeding.
- Perform bleeding operation with ENGINE RUNNING, to prevent damage to push rod seal. Make sure exhaust is suitably ventilated.
- Bleed the hydraulic system with the fluid reservoir filled to the specified level.
- Bleed the system starting with the rear wheel cylinder farthest from the master cylinder.
- A: Load sensing proportioning valve (If so equipped).

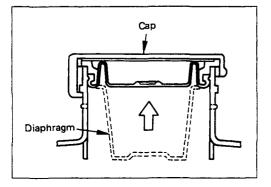












Fill the brake fluid reservoir with brake fluid.
 Handle the brake with reasonable care to avoid spillage as it is damaging to paint.

#### Note:

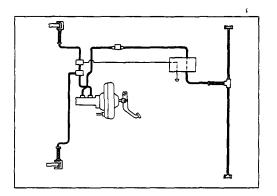
Take care to prevent foreign matter from entry, when replenishing or replacing brake fluid.

When pouring brake fluid, if diaphragm in the oil tank cap is stretched, be sure to place it into original position, (fasten it), and then cap it.

- 2. Connect a vinyl pipe to the bleeder screw on the wheel cylinder, caliper body or LSPV and the other end of the pipe in a transparent container.
- 3. Pump the brake pedal several times and hold it depressed. Loosen the bleed screw to release brake fluid together with air bubbles. Tighten the bleeder screw before pressure is released completely.
- 4. Repeat the step in paragraph 3 above until the air bubbles disappear completely. Securely tighten the bleeder screw when the air bubbles disappear completely.
- 5. Repeat the step in paragraph 4 above on the remaining wheel cylinders. Bleed the system starting with rear side farthest from the brake fluid reservoir.
- Fill the brake fluid reservoir to the specified level.
   Pour brake fluid carefully so as not to produce air bubbles.
- 7. If the cap diaphragm is stretched, fasten the diaphragm and the sure to cap it after it is placed to the original position.

#### Note:

Never reuse the old brake fluid.





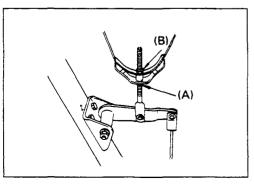
#### **BRAKE LINE (HOSES AND PIPES)**

- Inspect all hoses and pipes for wear, bending, chafing, cracks, dents, or any other damage. Make necessary correction or parts replacement if these abnormal conditions are found through inspection.
- All hoses, pipes and joints can be damaged easily. Do not allow the hose to become excessively twisted and bent when working with them, and pay special attention to all the brake lines not to damage them when repairing or replacing other parts (axle, suspension, etc).
- Inspection for leakage should be performed by depressing the brake pedal fully. If leakage is apparent at the circumference of joints, retighten or replace these parts. This procedure must be performed whenever brake lines are installed.
- After disconnecting the hoses and pipes, cap or tape the openings to prevent entry of foreign material.



# ADJUSTMENT PROCEDURE OF SERVICE AND PARKING BRAKE





#### Stem type

All brakes are self-adjusting.

Brake are adjusted by repeated stepping on the brake pedal.

The parking brake adjustment should be performed as follows:

- 1. Release the parking brake lever fully.
- 2. Loosen the lock nut (A).
- 3. Repeat stepping the brake pedal firmly and releasing it until the rear brake auto-adjuster completes the function.
- 4. Rotate the adjust nut (B) until all slack disappears from the cable.
- 5. Set the lock nut.

The parking brake lever travel is normal when the lever comes out 9 to 11 notches when pulled with a force of 30 kg (66 lbs.).

#### Floor mount type

All brakes are self-adjusting. Brakes are adjusted by repeated stepping on the brake pedal. (After stepping on the pedal and releasing it, the rear auto-adjuster, in the rear brake, produces a clicking sound. The same operation should be repeated until the sound disappears.)

Take the following steps after overhauling the rear brake assembly.

- 1. Move the parking brake lever to its fully released position.
- Parking cable must be loosened sufficiently. (Loosen the adjust nut and the lock nut.)
- Repeat stepping on the brake pedal firmly, and releasing it until the clicking sound can no longer be heard.

If the difference between the brake drum inside diameter of the brake shoes is adjusted to be 0.5 mm, the number of times for depressing the brake pedal can be reduced.

4. Remove the drum. Measure the brake drum inside diameter and diameter of the brake shoes.



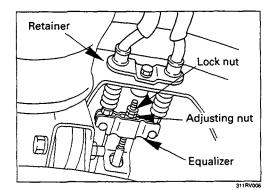
ç

Shoe Clearance

mm(in)

0.25 - 0.40 (0.0098 - 0.0157)

If incorrect, check the brake auto-adjusting system.



- Turn the equalizer nut so that the parking brake lever travels 6 or 7 notches when pulled up with a force 30 kg (66 lbs.).
- 6. Make sure there is not brake dragging and tighten the cable lock nut.



Torque

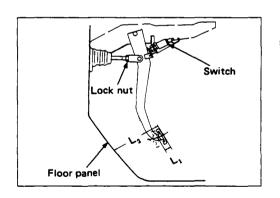
 $kg \cdot m(lb \cdot ft/N \cdot m)$ 

0.8 - 1.8 (5.8 - 13 / 8 -18)

# **....**

# ADJUSTMENT PROCEDURE OF BRAKE PEDAL

The push rod serves as the brake pedal stopper when the pedal is fully released. Brake pedal height adjustment should be performed as follows.





#### **Brake Pedal - Height**

Measure the brake pedal height after making sure the pedal is fully returned by the pedal return spring.

#### Note:

Pedal height  $(L_2)$  must be measured after starting the engine and increasing the revolution several times by stepping on the accelerator pedal.

		mr
Pedal free pla	y (L <sub>1</sub> )	6 - 10 (0.23 - 0.39)
Height (L <sub>2</sub> )	LHD	174 – 184 (6.85 – 7.24)
	RHD	193 - 203 (7.60 - 7.99)

#### Note:

Pedal free play must be measured after turning off the engine and stepping on the brake pedal firmly five times or more.

If the measured value deviates from the above range, adjust the brake pedal as follows:

- a) Disconnect the stop lamp switch.
- b) Loosen the lock nut on the push rod.
- c) Adjust the brake pedal to the specified height by rotating the push rod in the appropriate direction.



### Lock Nut Torque

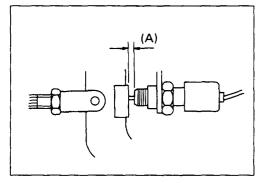
 $kg \cdot m(lb.ft/N \cdot m)$ 

1.5 - 2.5 (11 - 18 / 15 - 25)

d) Install the stop lamp switch.

#### Note:

Pedal height  $(L_2)$  must be 95 mm (3.7 in.) or more when applying about 50 kg (110.25 lbs.) of stepping force.





#### Clearance

Between the Switch Housing and the Brake Pedal (A)

mm(in)

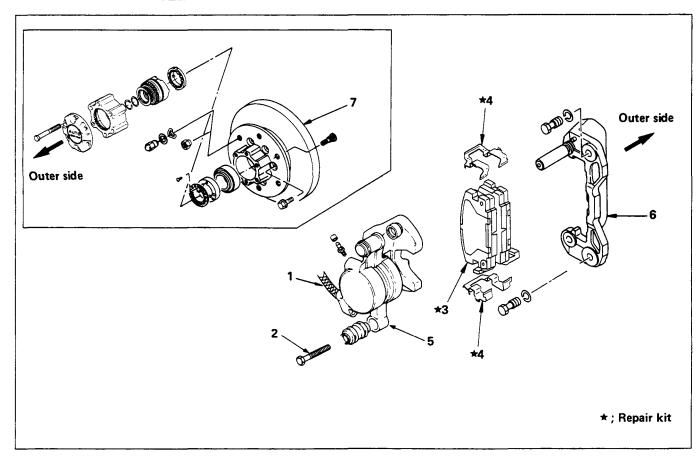
0.5 - 1.0 (0.02 - 0.04)

# FRONT BRAKE ASSEMBLY

**←→** 

# ++

# **REMOVAL AND INSTALLATION**

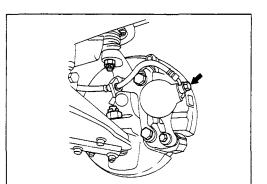


### **Removal Steps**

- ▲ 1. Brake flexible hose
- ▲ 2. Lock bolt
- ▲ 3. Pad assembly with shim
  - 4. Clip; pad
  - 5. Caliper assembly
- ▲ 6. Support bracket
- ▲ 7. Front hub and disc assembly

#### **Installation Steps**

- ▲ 7. Front hub and disc assembly
- ▲ 6. Support bracket
  - 5. Caliper assembly
- ▲ 4. Clip; pad
  - 3. Pad assembly with shim
- ▲ 2. Lock bolt
- ▲ 1. Brake flexible hose



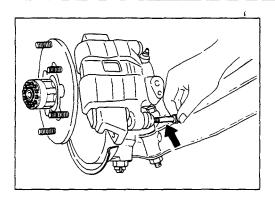


# Important Operations - Removal

#### 1. Brake Flexible Hose

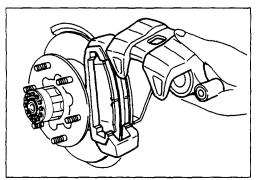
Remove the bolt and gasket and disconnect the brake flexible hose from the caliper.

After disconnecting the flexible hose, cap or tape the openings to prevent entry of foreign material.



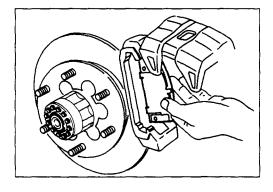
#### 2. Lock Bolt

Remove the lock bolt from the caliper.

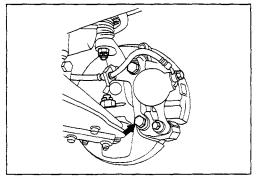


### 3. Pad Assembly with Shim

Rotate the caliper upward.



Mark the lining locations if they are to be reinstalled.

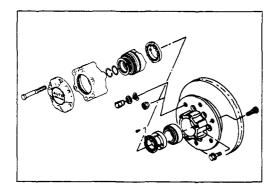


### 6. Support Bracket

Take care not to damage the flexible brake hose when removing the support bracket.

### 7. Front Hub and Disc Assembly

For the removal procedure, refer to Section 4C "FRONT WHEEL DRIVE".

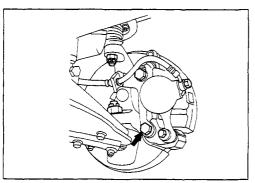




## Important Operations - Installation

#### 7. Front Hub and Disc Assembly

For the installation procedure, refer to the front hub and disc reassembly procedure in Section 4C "FRONT WHEEL DRIVE".





#### 6. Support Bracket

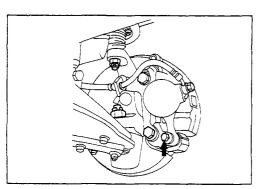
Torque kg-m(lb.ft/N-m)

14.2 - 17.4 (103 - 126 / 139 - 171)

Set up the clip and pad before installation of the support bracket.

#### 4. Clip; Pad

Install new parts if necessary.

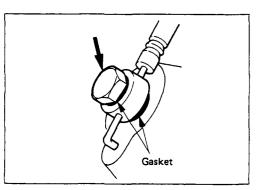




#### 2. Lock Bolt

Torque kg·m(lb.ft/N·m)

2.8 - 3.8 (20 - 27 / 27 - 37)





#### 1. Brake Flexible Hose

Attach the bolt and new gasket

Torque

3.0 - 4.0 (22 - 29 / 29 - 39)

kg·m(lb.ft/N·m)

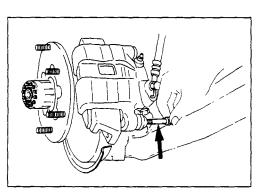


After installation, bleeding and replenishing procedure must be performed. Wipe the circumference of the hose clean.

#### Note:

- Always use new gaskets.
- Be sure to put the hooked edge of the flexible hose end into the anti-rotation cavity.

# ←→ | |→← REMOVAL AND INSTALLATION OF DISC PAD





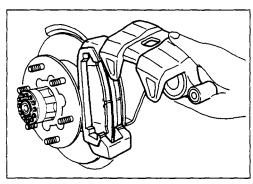
### **Removal Steps**

### 1. Lock Bolt

Remove the lock bolt from the caliper.

Note:

Don't remove the brake hose from caliper when replacing

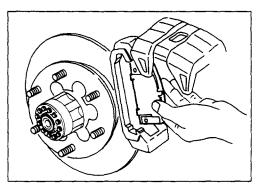


#### 2. Rotate the Caliper Upward

Remove the caliper from the support bracket and wire the caliper to the upper link or the frame.

Note:

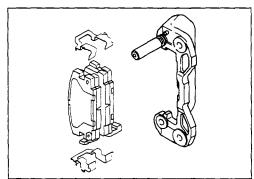
While caliper is removed from support bracket, never step on the brake pedal or the piston will protrude rapidly.



#### 3. Pad Assembly with Shim

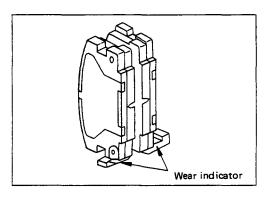
Remove the pad assembly with the shim.

Mark the pad locations if they are to be reinstalled.



#### 4. Clip; Pad

Discard the used clip and install a new one.



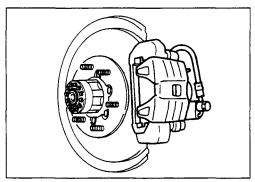


# Installation Steps

1. Clip; Pad

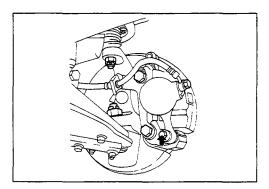
#### 2. Pad Assembly with Shim

After attaching the pad assembly with the shim to the support bracket, position the wear indicator to the lower side of the pad.



## 3. Caliper Assembly

Lower the caliper into its original position. Do not damage the flexible hose by twisting or pulling it.





#### 4. Lock Bolt

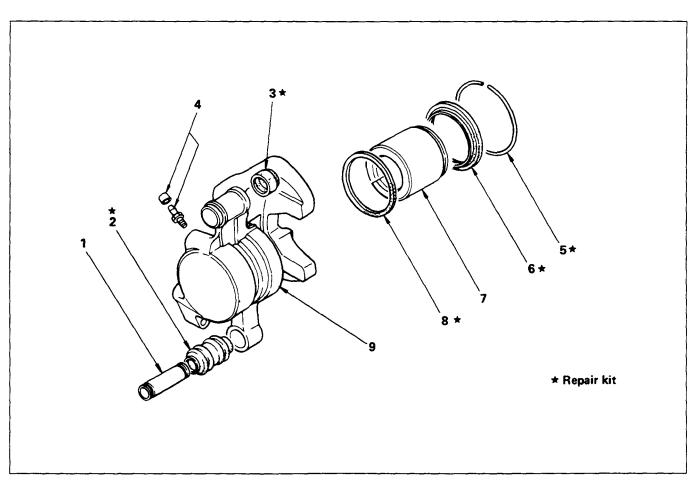
Attach the lock bolt to the caliper.

Torque	kg-m(lb.ft/N-m)

2.8 - 3.8 (20 - 27 / 27 - 37)

# DISASSEMBLY

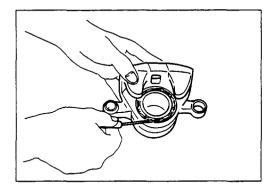
## **CALIPER ASSEMBLY**



# **Disassembly Steps**

- 1. Sleeve
- 2. Dust boot; sleeve
- 3. Dust boot; guide pin
- 4. Bleeder with cap
- ▲ 5. Dust seal ring

- 6. Dust seal; piston
- ▲ 7. Piston (with seal ring)
  - 8. Ring seal
  - 9. Body; caliper

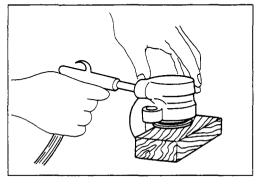




## **Important Operations**

#### 5. Dust Seal Ring

Using a small screwdriver, remove the dust boot.



#### 7. Piston (with Ring Seal)

Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior tor removal of dust seal.

#### **CAUTION:**

Do not place your fingers in front of the piston in an attempt to catch or protect it when applying compressed air.

# INSPECTION AND REPAIR

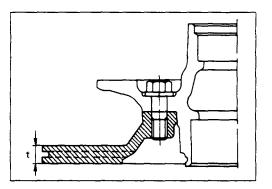
Make necessary correction or parts replacement if wear damage or any other abnormal conditions are found through inspection.

- Rotor
- Caliper body
- · Cylinder bore
- Piston
- Support bracket
- · Lock boit
- · Guide pin



#### **Visual Check**

Inspect the following parts for wear, bending, distortion, cracking, corrosion, or other abnormal conditions.



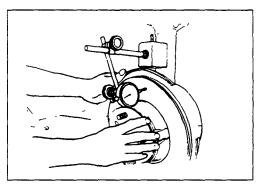


#### Rotor

• Thickness (t)

mm(in)

Standard	Minimum thickness after refinishing	Replacement thickness (Discard)
22.0 (0.866)	20.97 (0.826)	20.6 (0.811)





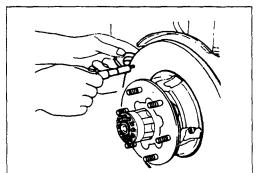
Run out

Limit

mm(in)

0.13 (0.005)

Before inspection, adjust the wheel bearing correctly. Using a dial gauge, measure the run out at the center of disc pad contact surface.





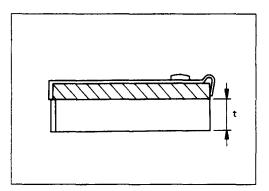
• Parallelism (Total circumferential thickness variation)

Limit

mm(in)

0.015 (0.0006)

Contact surface must be within 0.015 mm at the circumference of 203 mm dia. circle.





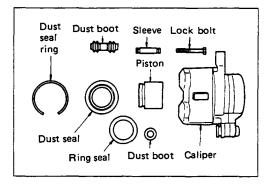
#### Thickness of Disc Pad

I nickness (t)		mm(ir	
_	Standard	Limit	
-	10.5 (0.413)		
-	9.5 (0.374)	1.0 (0.039)	
	(For Australia only)		

Replace the front disc pad whenever the pad wear indicator makes a squeaking noise or when the pad is worn to within 1 mm of the shoe table.



All four brake pads should be replaced together.



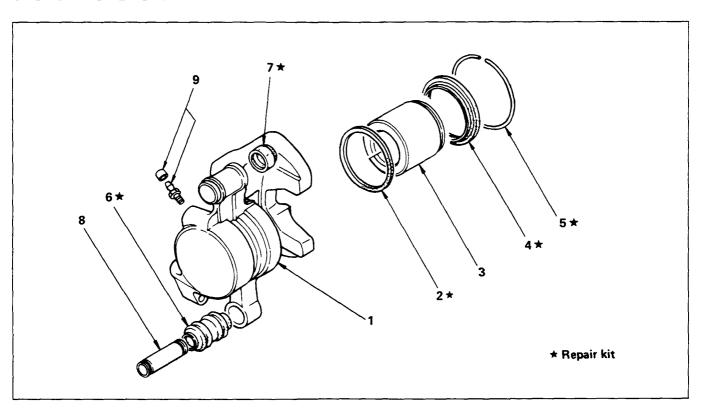
#### **Seal and Boot**

The dust seal, dust boot and ring seal are to be replaced each time the caliper is overhauled.

Discard thee used rubber parts.

# \*\* REASSEMBLY

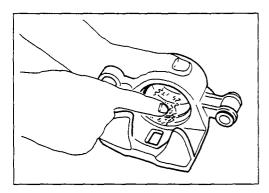
#### **CALIPER ASSEMBLY**



# **Disassembly Steps**

- ▲ 1. Body; caliper
- ▲ 2. Ring seal
- ▲ 3. Piston
- ▲ 4. Dust seal; piston
- ▲ 5. Dust seal ring

- ▲ 6. Dust boot; sleeve
- ▲ 7. Dust boot ; guide pin
  - 8. Sleeve
- ▲ 9. Bleeder with cap





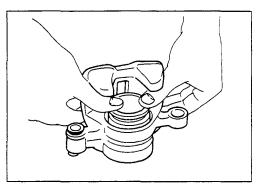
# **Important Operations**



- 1. Body; Caliper
- 2. Ring Seal

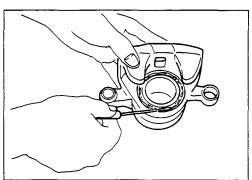
Apply special grease to the ring seal and cylinder wall, then insert the ring seal into the cylinder.

The special grease is included in the repair kit.



#### 3. Piston

When inserting the piston into the cylinder, use finger pressure only. Do not use a mallet or other impact tools, since damage to the cylinder wall or ring seal can result.

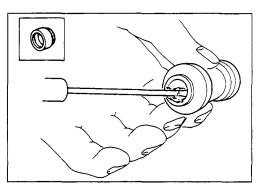




#### 4. Dust Seal; Piston

#### 5. Dust Seal Ring

Apply special grease (Approx. 1 g) to the piston and attach the dust seal to the piston and caliper. Insert the dust seal ring into the dust seal.

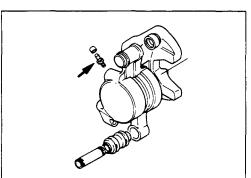




### 6. Dust Boot; Sleeve

#### 7. Dust Boot; Guide Pin

Install the sleeve dust boot on the caliper after applying special grease (Approx. 1 g) into the sleeve and guide pin boots, then insert the sleeve into the dust boot.





## 9. Bleeder with Cap

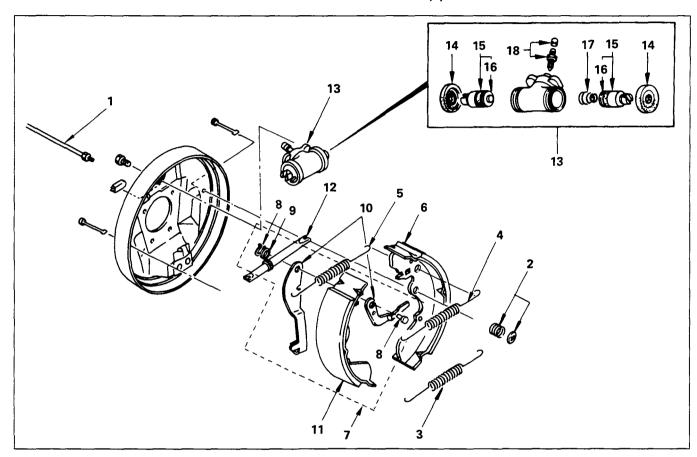
Torque kg·m(lb.ft/N·m)

0.6 - 0.9 (4.3 - 6.5 / 5.9 - 8.8)

# **REAR DRUM BRAKE ASSEMBLY**



First, disassemble the brake drum. Then disassemble the rear brake assembly. Refer to the "REAR AXLE" section for the brake drum disassembly procedure.



#### **MAJOR COMPONENTS**

## **Disassembly Steps**

- 1. Brake line
- 2. Holding spring and cups
- ▲ 3. Return spring; lower
  - 4. Return spring; upper (shoe to adjust lever)
  - 5. Return spring; upper (shoe to shoe)
  - 6. Shoe assembly (primary)

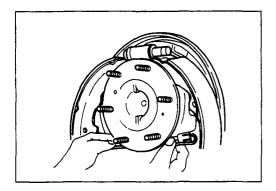
- 7. Shoe assembly with lever
- 8. Retainer with pin
- 9. Washer; wave
- 10. Lever ; auto adjuster
- 11. Shoe assembly (secondary)
- 12. Adjuster assembly
- 13. Wheel cylinder assembly

#### MINOR COMPONENTS

# Disassembly Steps Wheel Cylinder Assembly (13)

- 14. Boot; wheel cylinder
- 15. Piston assembly
- 16. Cup; piston

- 17. Return spring; piston
- 18. Bleeder; wheel cylinder



# **Important Operations**

3. Return Spring; Lower

# INSPECTION AND REPAIR

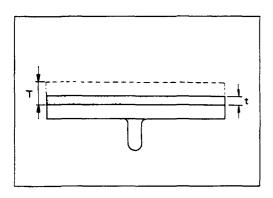
Make necessary correction or parts replacement if wear damage or any other abnormal conditions are found through inspection.

- Brake drum
- Back plate
- Brake lining
- Wheel cylinder body
- Piston
- Piston cup
- Return spring



#### **Visual Check**

Inspect the following parts for wear scuffs, scratches, corrosion, stains, deterioration, or other abnormal conditions.

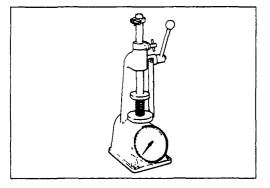




#### Thickness of the Brake Lining

nickness		mm	
	Standard (T)	Limit (t)	
TFR	5.0 (0.197)	1.0 (0.039)	
TFS	4.0 (0.157)	1.0 (0.039)	

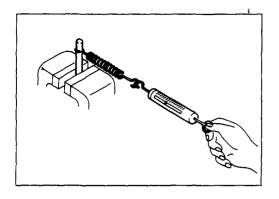
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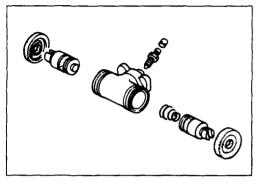


## Inspection of the Return Spring

	Free length mm(in.)	Set length mm(in.)	Set load kg(lbs.)
Holding spring	15.0 (0.591)	11.2 (0.441)	10.0 ± 1.0 (22.3 ±2.2)
Wheel cylinder spring	37.4 (1.472)	8.0 (0.315)	1.0 ±0.1 (2.2 ±0.2)



	Free length mm(in.)	Set length mm(in.)	Set load kg(lbs.)
Return spring: upper (adjust lever)	124.9 (4.917)	134.9 (5.311)	7 ± 0.7 (15.4 ±1.6)
Shoe return spring: upper	112.4	121.5	2 ±0.2
	(4.425)	(4.783)	(4.4 ±0.4)
Shoe return spring: lower	167.2	190.2	28.0 ±2.8
	(6.583)	(7.488)	(61.7 ±6.4)





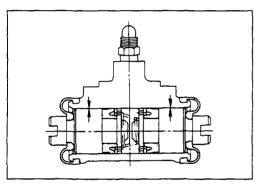
#### **Clean Wheel Cylinder Parts**

Always use clean brake fluid to clean wheel cylinder parts.



#### Note:

Do not use mineral-base cleaning solvents such as gasoline, kerosene, acetone, paint thinner, or carbon tetrachloride.

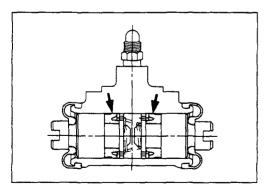




#### Clearance Between the Wheel Cylinder and the Piston

mm(in)

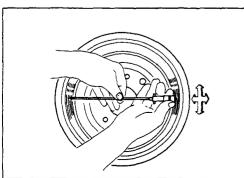
***************************************
Limit
0.15 (0.006)





#### **Piston Cups**

Inspect the piston cups for wear, distortion, fatigue or other abnormal conditions.



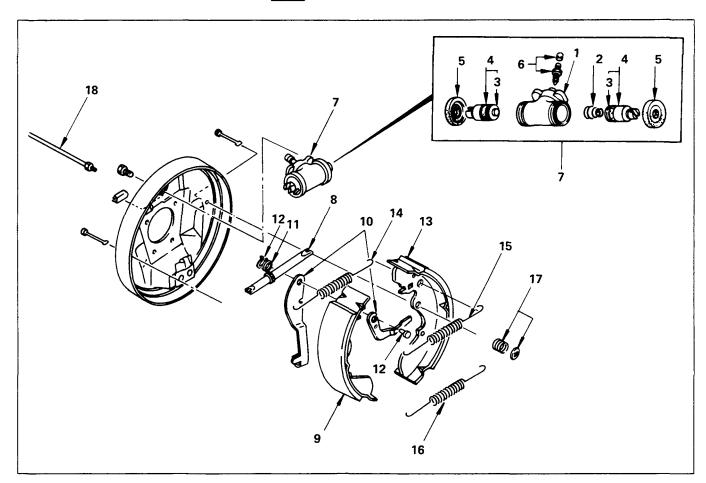


#### Measuring the Brake Drum

mm(in)

		Standard	Limit
TFR	Inside diameter	254 (10.000)	255.5 (10.059)
IFN	Run out	0.05 (0.002)	0.15 (0.006)
TFS	Inside diameter	295 (11.614)	296.5 (11.673)
11-5	Run out	0.05 (0.002)	0.15 (0.006)

# REASSEMBLY



#### MINOR COMPONENTS

# Reassembly Steps Wheel Cylinder Assembly (7)

- ▲ 1. Body; wheel cylinder
  - 2. Return spring; piston
  - 3. Cup; piston

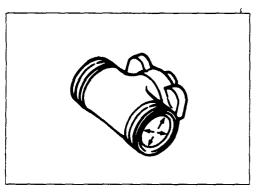
- ▲ 4. Piston assembly
  - 5. Boot; wheel cylinder
- ▲ 6. Bleeder; wheel cylinder

#### **MAJOR COMPONENTS**

# **Reassembly Steps**

- ▲ 7. Wheel cylinder assembly
  - 8. Adjuster assembly
  - 9. Shoe assembly (secondary)
  - 10. Lever; auto adjuster
  - 11. Washer; wave
  - 12. Retainer with pin
  - 13. Shoe assembly (primary)

- 14. Return spring; upper (shoe to shoe)
- 15. Return spring; upper (shoe to adjust lever)
- 16. Return spring; lower
- 17. Holding spring and cups
- ▲ 18. Brake line

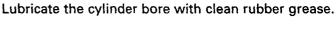


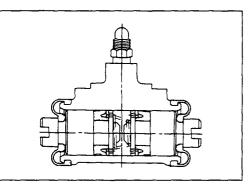
# **Important Operations**



### 1. Body; Wheel Cylinder



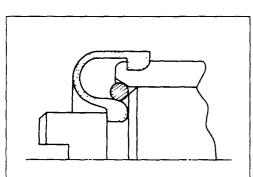




# 4. Piston Assembly

Install new piston cups on each piston so that the flared end of the cups are turned to the inboard side of the pistons.

Attach the return spring and the boot to the piston.





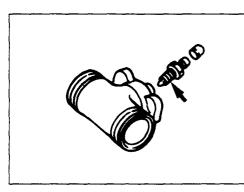
Apply DELCO silicone lube No. 5459912 (or equivalent) to the piston and the inner face of the boots.



# 6. Bleeder; Wheel Cylinder

**Torque**  $kg \cdot m(lb.ft/N \cdot m)$ 

0.7 - 1.2 (5.1 - 8.7 / 6.9 - 11.8)

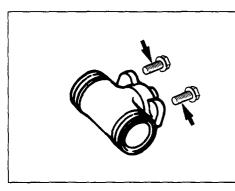


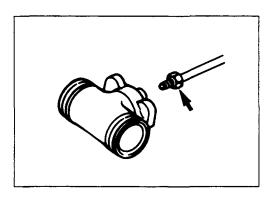


# 7. Wheel Cylinder Assembly

oraue			kg·m(lb.ft/N·m)
orque	 	 	kg-111(10.1(/14-111)

1.1 – 1.5 (8 – 11 / 11 – 15)





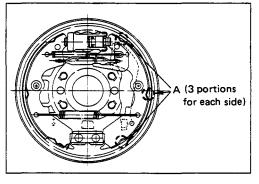


## 18. Brake Line

Torque

kg·m(lb.ft/N·m)

1.3 - 1.9 (9 - 14 / 13 - 19)





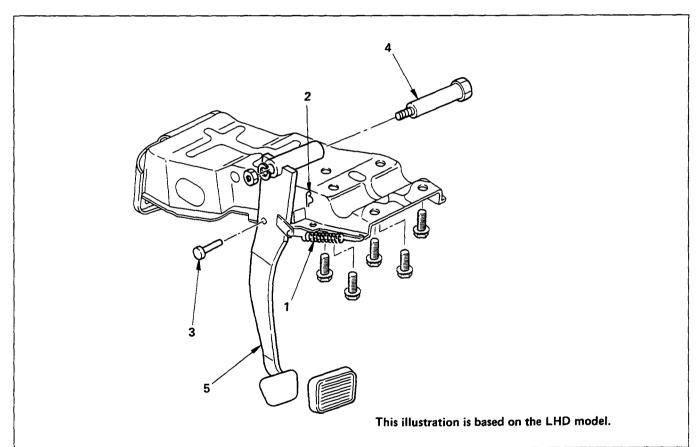
Apply grease lightly to back plate A.

# **BRAKE CONTROL**



# REMOVAL AND INSTALLATION

### **BRAKE PEDAL ASSEMBLY**



## **Removal Steps**

- 1. Return spring
- 2. Snap pin
- 3. Pin; push rod to pedal
- 4. Pin ; fulcrum, pedal to bracket
- 5. Pedal assembly with bush

# **Installation Steps**

To install, follow the removal procedure in reverse order.

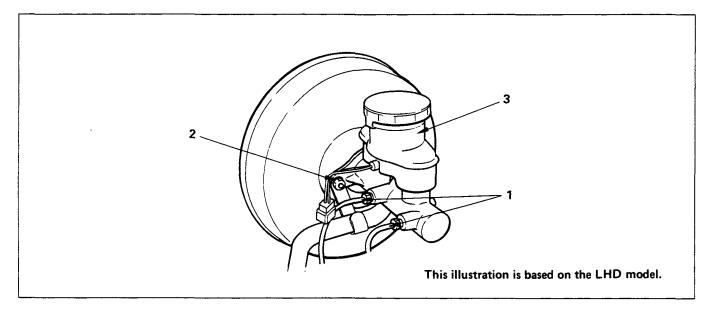
Before installation, apply grease to the entire circumference of the fulcrum pin (4) and push rod pin (3).

Refer to "SERVICING" in this section for adjustment procedure of brake pedal.

# **MASTER CYLINDER**



# **→←** REMOVAL AND INSTALLATION

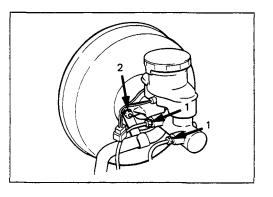


## **Removal Steps**

- ▲ 1. Brake line
  - 2. Nut; master cylinder to vacuum servo
  - 3. Master cylinder assembly

# Installation Steps

- 3. Master cylinder assembly
- ▲ 2. Nut; master cylinder to vacuum servo
- 1. Brake line





# Important Operation - Removal

#### 1. Brake Line

Be very careful not to spill brake fluid on the painted surface. Damage to the painted surface will result.



# Important Operation - Installation



# 2. Nut; Master Cylinder to Vacuum Servo

Torque

kg·m(lb.ft/N·m)

1.0 - 1.6 (7 - 12 / 9.8 - 16)



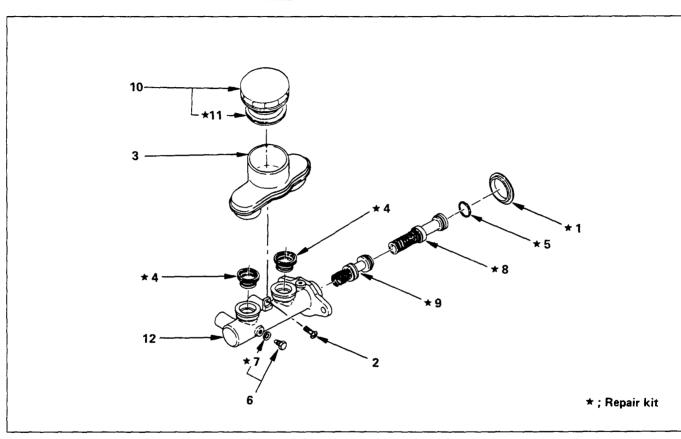
#### 1. Brake Line

Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

0.9 - 1.5 (6.5 - 11 / 8.8 - 15)





# Disassembly Steps

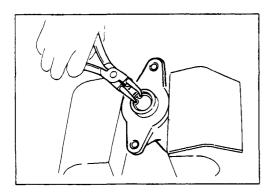
- 1. Dust seal
- 2. Screw
- 3. Reservoir; fluid, brake
- 4. Grommet
- ▲ 5. Ring; snap▲ 6. Bolt; stopper

- 7. Gasket
- ▲ 8. Piston assembly; primary and spring
- lacktriangle 9. Piston assembly ; secondary and spring
  - 10. Cover ; fluid reservoir
  - 11. Seal
  - 12. Cylinder assembly; brake, master



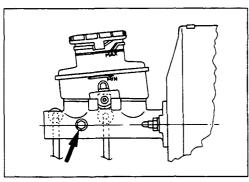
# **Important Operations**

When disassembling, inspecting or reassembling the master cylinder assembly, take care not to bring the parts into contact with mineral oil or dust. Wash the piston cups only with brake fluid. Do not use gasoline or other mineral-base cleaning solvents.



#### 5. Ring; Snap

Remove the snap ring from the cylinder body with pushing in the primary and secondary pistons.

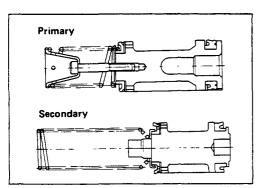


### 6. Bolt; Stopper

Push in the primary and secondary pistons and remove the stopper bolt completely from the cylinder body, then remove the primary and secondary piston assemblies.

- 8. Piston Assembly; Primary and Spring
- 9. Piston Assembly; Secondary and Spring

Don't remove the spring from the piston.





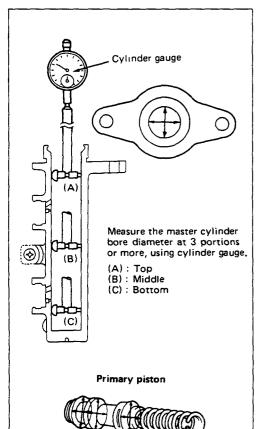
# **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear damage or any other abnormal conditions are found through inspection.

- Cylinder inside face
- Piston
- Piston cap
- Piston cap spacer
- Return port
- · Return spring

#### Visual Check

Inspect the following parts for wear, distortion, cuts, nicks, corrosion, or other abnormal conditions.



Secondary piston



#### **Master Cylinder Bore Diameter**

Standard mm(in)

23.81 (0.938)



# Clearance between the Master Cylinder and the Piston

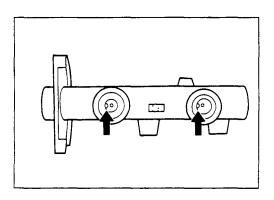
Measure the outer diameter of the piston assembly at the portions shown in the left figure.

m	m	/i	n۱
111	111	١,	117

	11111111111
Standard	Limit
0.04 - 0.125 (0.00158 - 0.00493)	0.15 (0.00591)

#### Note:

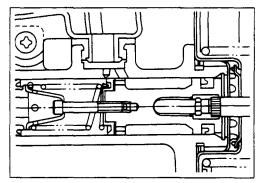
If the clearance deviates from the range shown above, replace the master cylinder and the piston assembly together.





#### **Return Port**

Check the return port for obstructions and if necessary, clean with a tag wire. Blow away foreign matter with compressed air.



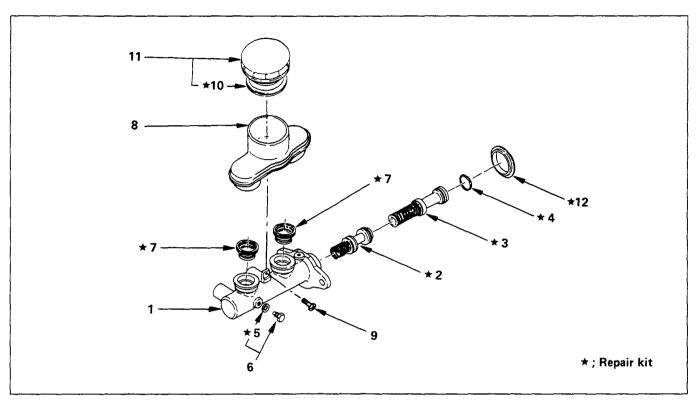


### **Primary Piston**

After reassembly, push in the primary piston to see that it returns smoothly.

Repeat the test two or three times to see that brake fluid is forced out from the front and rear outlets.

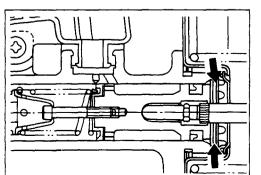




# **Reassembly Steps**

- ▲ 1. Cylinder assembly; brake, master
- ▲ 2. Piston assembly; secondary and spring
- ▲ 3. Piston assembly ; primary and spring
  - 4. Ring; snap
  - 5. Gasket

- ▲ 6. Bolt; stopper
- ▲ 7. Grommet
  - 8. Reservoir; fluid, brake
- ▲ 9. Screw
  - 10. Seal
  - 11. Cover; fluid reservoir
- ▲ 12. Dust seal



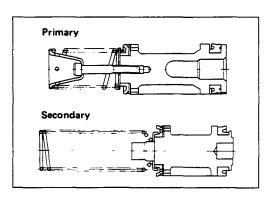


## **Important Operations**



## 1. Cylinder Assembly ; Brake, Master

Lubricate the master cylinder bore with clean rubber grease. (arrowed portion)





### 2. Piston Assembly; Secondary and Spring

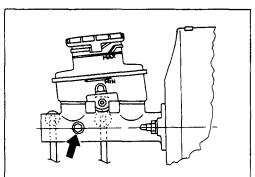
# 3. Piston Assembly ; Primary and Spring

Lubricate the piston cups on the primary piston assemblies with rubber grease.

Take care not to scratch the piston cup when installing the piston assemblies.

Note:

Don't remove the spring from the piston.

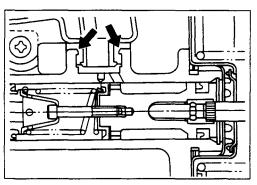




### 6. Bolt; Stopper

Depress the primary piston and install the piston stopper bolt with a new gasket.

Torque	kg⋅m	(lb.ft/N·m)
	0.7 - 0.9 (5.1 - 6.5 / 6.9 - 8.8)	

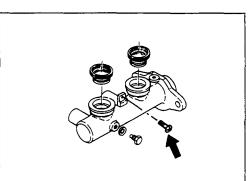




#### 7. Grommet

Lubricate the new grommets with clean rubber grease. Insert the grommets, with the flared side up, into the cylinder body.

Apply rubber grease to the dust seal portion. (The portion indicated by the arrows in the left diagram.)

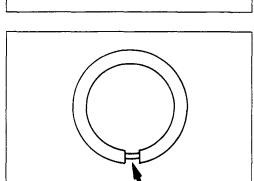




## 9. Screw

Torque kg-m(lb.ft/N·m)

0.10 - 0.20 (0.7 - 1.5 / 1.0 - 2.0)



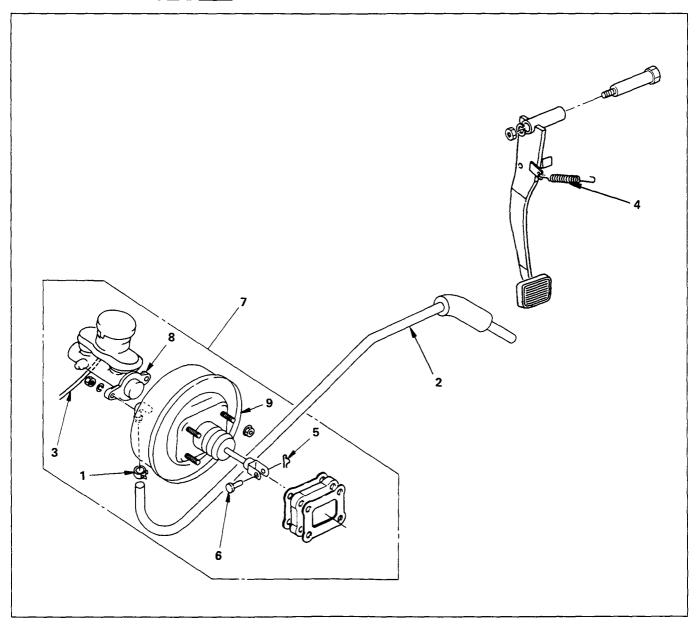


#### 12. Dust Seal

Install the dust seal so that its groove faces downward.

# **VACUUM SERVO**

# REMOVAL AND INSTALLATION

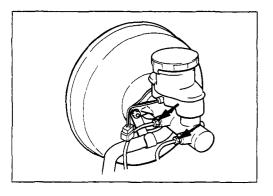


## **Removal Steps**

- 1. Clamp; vacuum hose
- 2. Vacuum hose
- ▲ 3. Brake line
  - 4. Return spring; brake pedal
  - 5. Snap pin
  - 6. Pin; push rod to brake pedal
  - 7. Vacuum servo to dash panel and pedal mounting bracket
  - 8. Master cylinder assembly
  - 9. Vacuum servo assembly

## **Installation Steps**

- 9. Vacuum servo assembly
- ▲ 8. Master cylinder assembly
- 7. Vacuum servo to dash panel and pedal mounting bracket
  - 6. Pin; push rod to brake pedal
  - 5. Snap pin
  - 4. Return spring; brake pedal
- ▲ 3. Brake line
- 2. Vacuum hose
  - 1. Clamp; vacuum hose

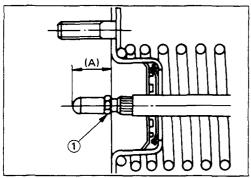




#### Important Operation - Removal

#### 3. Brake Line

When handling, be careful not to spill brake fluid over the painted surfaces, as damage to the paint finish will result.





#### Important Operation - Installation



#### 8. Master Cylinder Assembly

Check the distance from the flange face of the vacuum servo to the end of the push rod before installation of the master cylinder.



Projection (A)

mm(in)

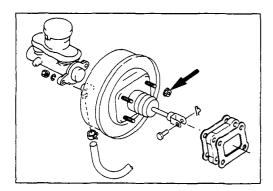
18.0 - 18.2 (0.709 - 0.717)

If the measured distance deviates from the specified range, make an adjustment with the lock nut ① at the end of the push rod.

Torque

kg·m(lb.ft/N·m)

1.5 - 2.5 (11 - 18 / 15 - 25)





## 7. Vacuum Servo to Dash Panel and Pedal Mounting Bracket

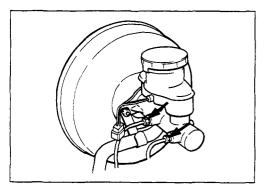
Torque

kg-m(lb.ft/N-m)

2.2 - 3.2 (16 - 23 / 22 - 31)



Apply sealer to the dashboard fitting face.



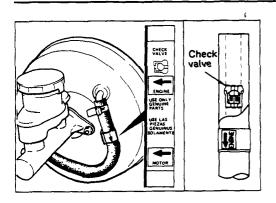


#### 3. Brake Line

Torque

kg·m(lb.ft/N·m)

0.9 - 1.5 (6.5 - 11 / 9 - 15)





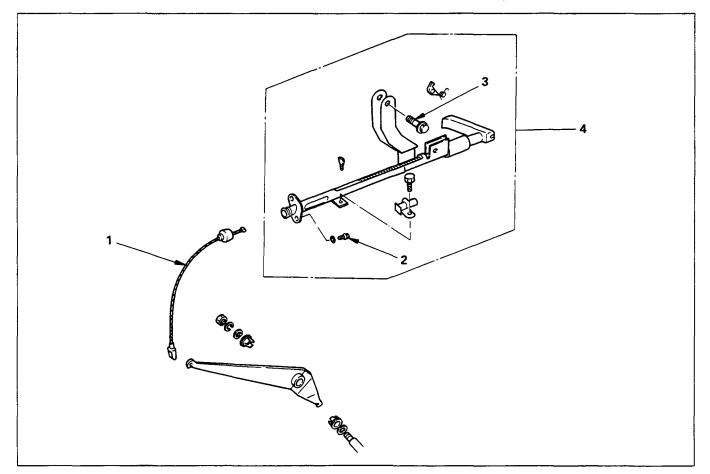
#### 2. Vacuum Hose

- When removing or replacing the vacuum hose make sure that the arrow on the label of the hose is facing the engine.
- 2) Also confirm that the check valve is facing the engine.

#### PARKING BRAKE (STEM TYPE)



#### PARKING BRAKE STEM ASSEMBLY (LEFT HAND DRIVE MODEL)



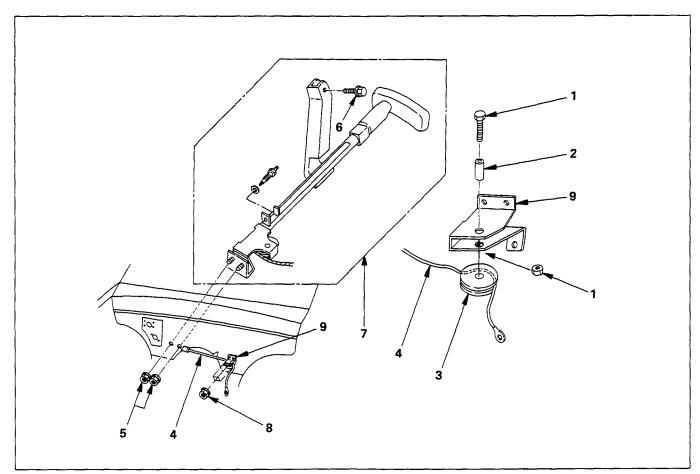
#### **Removal Steps**

- 1. Cable front, relay lever side
- 2. Bolt; bracket to dash
- 3. Bolt ; bracket to cross beam4. Parking brake stem assembly

#### **Installation Steps**

To install, follow the removal procedure in reverse order.

#### PARKING BRAKE STEM ASSEMBLY (RIGHT HAND DRIVE MODEL)



#### **Removal Steps**

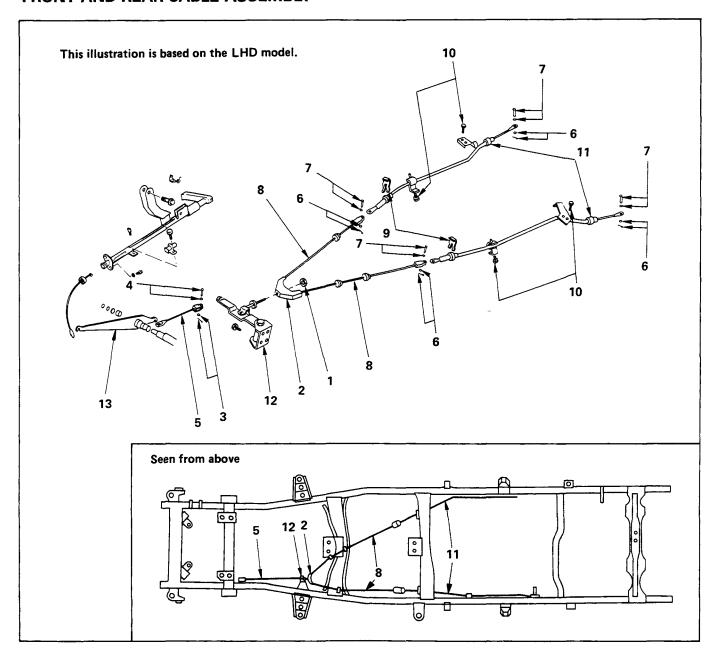
- 1. Bolt and nut
- 2. Collar
- 3. Roller
- 4. Cable front, relay lever side
- 5. Nuts; bracket to dash
- 6. Bolt; bracket to cross beam
- 7. Parking brake stem assembly
- 8. Nuts
- 9. Bracket; roller

#### **Installation Steps**

To install, follow the removal procedure in reverse order.

Before installation, apply chassis grease to the roller (3)'s contact surface to the collar (2) and cable (4).

#### FRONT AND REAR CABLE ASSEMBLY

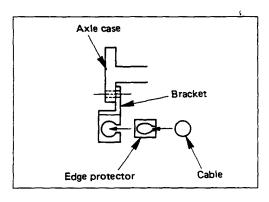


#### **Removal Steps**

- 1. Nut
- 2. Equalizer bracket
- 3. Snap pin, with plain washer
- 4. Pin with curved washer
- 5. Cable; front lower
- 6. Snap pin, with plain washer
- 7. Pin with curved washer
- 8. Intermediate cable
- 9. Clip
- 10. Clip; fixing bracket
- ▲ 11. Cable assembly; rear
  - 12. 2nd relay lever assembly with return spring
  - 13. 1st relay lever assembly

#### **Installation Steps**

- ▲ 13. 1st relay lever assembly
- ▲ 12. 2nd relay lever assembly with return spring
  - 11. Cable assembly; rear
  - 10. Clip; fixing bracket
  - 9. Clip
- ▲ 8. Intermediate cable
- ▲ 7. Pin with curved washer
- ▲ 6. Snap pin, with plain washer
  - 5. Cable; front lower
  - 4. Pin with curved washer
- ▲ 3. Snap pin, with plain washer
  - 2. Equalizer bracket
  - 1. Nut

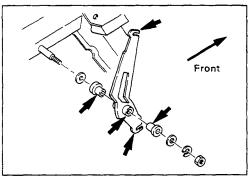




#### **Important Operations - Removal**

#### 11. Cable Assembly; Rear

When abrasion or wear is evident on edge protector, in must be replaced with new one.

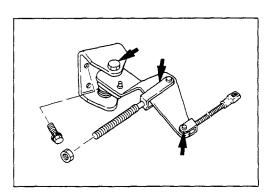




#### Important Operations - Installation

#### 13. 1st Relay Lever Assembly

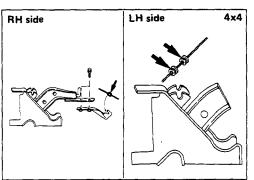
Apply grease (BESCO L-2 or equivalent) to the inner and outer surface of the bushes and cable connecting portions.





#### 12. 2nd Relay Lever Assembly with Return Spring

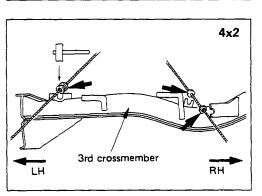
Apply grease (BESCO L-2 or equivalent) to the arrowed portion in the left figure.

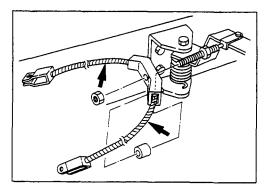




#### 8. Intermediate Cable

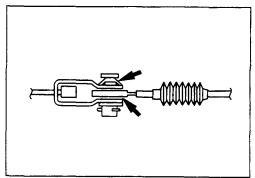
After applying grease (BESCO L-2 or equivalent) to the cable guide, set it to the bracket by striking lightly with a mallet.







Apply grease (BESCO L-2 or equivalent) to the arrowed portion in the left figure.





#### 7. Pin with Curved Washer

Apply grease (BESCO L-2 or equivalent) to the circumference of the pin and joint.

- 6. Snap pin, with Plain Washer
- 3. Snap pin, with Plain Washer

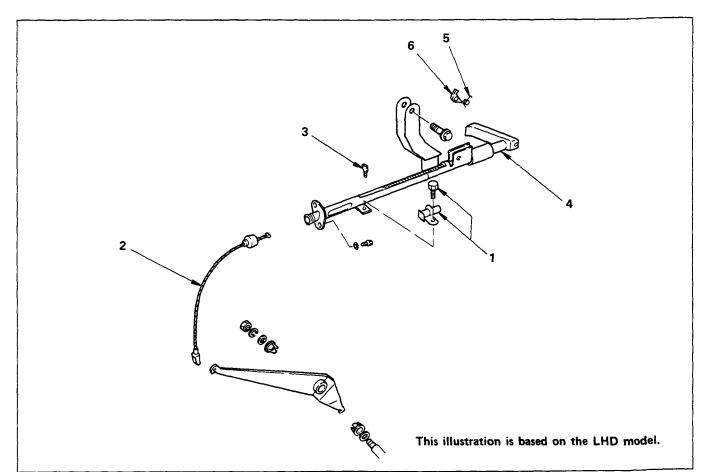
Discard the used snap pins and use new parts.





### → DISASSEMBLY AND REASSEMBLY

#### PARKING BRAKE STEM ASSEMBLY

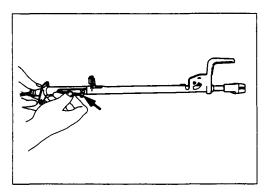


#### **Disassembly Steps**

- 1. Switch; parking brake and bolt
- ▲ 2. Cable; front
- ▲ 3. Switch actuating pin
  - 4. Stem
  - 5. Spring
  - 6. Pole

#### **Reassembly Steps**

- ▲ 6. Pole
  - 5. Spring
- ▲ 4. Stem
- 3. Switch actuating pin
- ▲ 2. Cable; front
  - 1. Switch; parking brake and bolt

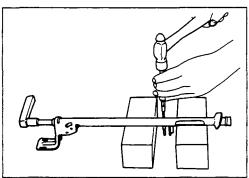




#### **Important Operations - Disassembly**

#### 2. Cable; Front

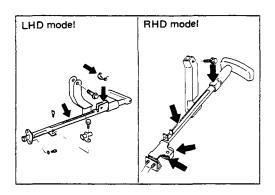
Manually release the lever ratchet and depress the stem until the cable attachment at the lower end of the stem is visible. Remove the cable from the stem lower end.





#### 3. Switch Actuating Pin

Align the parking brake switch actuating pin with the hole in the housing. Using a flat head punch, drive out the pin.



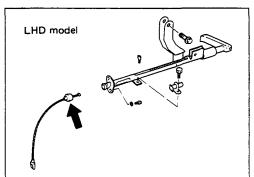


#### Important Operations - Reassembly

#### 6. Pole



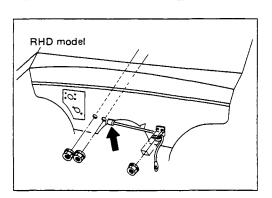
Before reassembly, apply chassis grease to the arrowed portion in the left figures.





#### 2. Cable; Front

Before reassembly, apply chassis grease to the entire inside surface of the cable boot (arrowed in the left figure) fully.





### **INSPECTION AND REPAIR**

Make necessary adjustments, repairs, and parts replacements if wear, damage or other problems are discovered during inspection.



Adjustment Procedure of Parking Brake

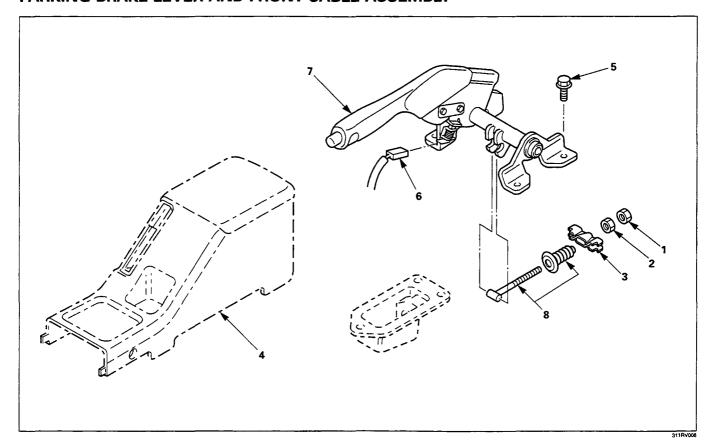
• Parking brake

Refer to "SERVICING" in this section for adjustment procedure of parking brake.

#### PARKING BRAKE (FLOOR MOUNT TYPE)

++ REMOVAL AND INSTALLATION

#### PARKING BRAKE LEVER AND FRONT CABLE ASSEMBLY



#### **Removal Steps**

- 1. Lock nut
- 2. Adjust nut
- 3. Equalizer
- 4. Center console
- 5. Bolt
- 6. Switch connector
- 7. Parking brake lever
- 8. Parking brake front cable

#### Installation Steps

- ▲ 8. Parking brake front cable
  - 7. Parking brake lever
  - 6. Switch connector
- ▲ 5. Bolt
  - 4. Center console
  - 3. Equalizer
  - 2. Adjust nut
  - 1. Lock nut



#### Important Operation - Installation



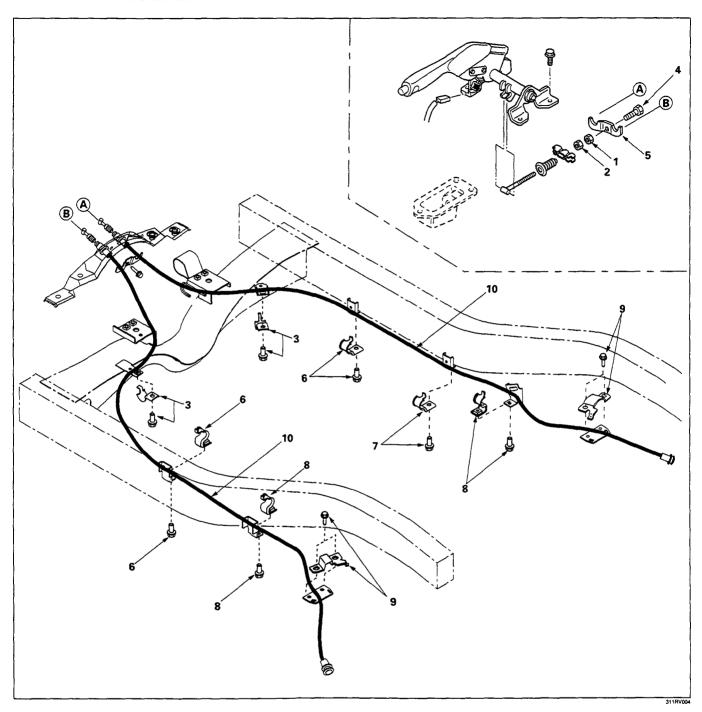
#### 8. Parking Brake Front Cable

Apply grease (BESCO L-2 or equivalent) to the front cable before installation.



After installation, be sure to adjust the parking brake. Refer to "SERVICING" of this section.

#### **REAR CABLE ASSEMBLY**

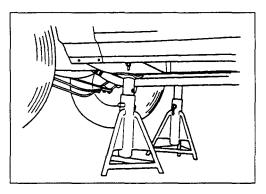


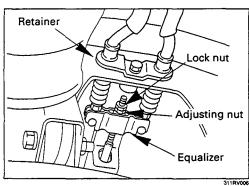
#### **Removal Steps**

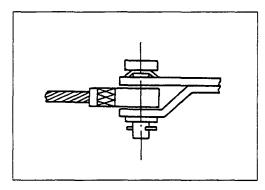
- ▲ 1. Lock nut
- ▲ 2. Adjusting nut
  - 3. Clip and bolt; cross member
- ▲ 4. Bolt
- ▲ 5. Retainer
  - 6. Clip and bolt; side member
  - 7. Clip and bolt; side member
  - 8. Clip and bolt; spring eye
  - 9. Clip and bolt; leaf spring
- ▲10. Hand brake rear cable

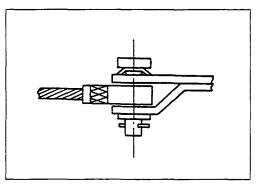
#### **Installation Steps**

- ▲10. Hand brake rear cable
- ▲ 9. Clip and bolt; leaf spring
- ▲ 8. Clip and bolt; spring eye
- ▲ 7. Clip and bolt; side member
- ▲ 6. Clip and bolt; side member
- ▲ 5. Retainer
- ▲ 4. Bolt
- ▲ 3. Clip and bolt; cross member
- ▲ 2. Adjusting nut
- ▲ 1. Lock nut











#### **Important Operations - Removal**

#### Preparation

- Raise vehicle to the working level. Support the axle assembly with the proper jack and chassis stands.
- · Remove the tire and wheel.
- · Remove the brake drum.
- 1. Lock Nut
- 2. Adjusting Nut
- 4. Bolt
- 5. Retainer
  - Loosen lock nut and adjusting nut, then disconnect rear cable from the equalizer.
  - Remove bolt and retainer.
  - Remove pin and curved washer of the rear brake, then disconnect rear cable.



#### Important Operations – Installation



- 10. Hand Brake Rear Cable
  - Apply grease (BESCO L-2 or equivalent) to the circumference of the pin and joint.
  - Apply grease (BESCO L-2 or equivalent) to the equalizer joint portion.
- 9. Clip and Bolt; Leaf Spring
- 8. Clip and Bolt; Spring Eye
- 7. Clip and Bolt; Side Member
- 6. Clip and Bolt; Side Member
- 3. Clip and Bolt; Cross Member



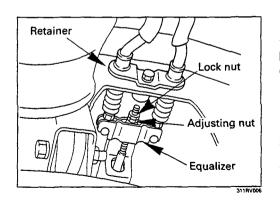
Torque kg-m(lb.ft/N-m)

0.6 (4.3 / 6)

- 5. Retainer
- 4. Bolt



Torque		kg·m(lb.ft/N·m)
	0.6 (4.3 / 16)	



#### 2. Adjusting Nut

#### 1. Lock Nut

- Apply grease (BESCO L-2 or equivalent) to the front cable contact portion.
- Connect rear cable to the equalizer, then adjust the parking brake. Refer to "SERVICING".
- Tighten lock nut to the specified torque.



Torque		kg·m(lb.ft/N·m)
	0.6 (4.3 / 16)	

#### **TROUBLESHOOTING**

Condition and Cause	Correction
Poor Brake Action	
Master cylinder faulty	Correct or replace
Power cylinder faulty	Correct or replace
Level of brake fluid in reservoir too low	Replenish and bleed
Air in hydraulic circuit	Bleed
Front disc brake caliper faulty	Clean or replace
Rear brake wheel cylinder faulty	Clean or replace
Water or oil on brake pads or linings	Clean or replace
Brake pads or linings hardened	Replace
Brake pads or linings in poor contact with rotor or brake drum	Correct
Brake pads or linings worn	Replace
Brake disc or drum rusted	Grind or replace
Check valve in vacuum hose faulty	Correct or replace
Brake Squeak	Perlan
Brake pads or linings worn	Replace
Brake pads or linings hardened	Replace
Brake pads or linings in poor contact with rotor or brake drum	Correct
Brake disc(s) warped, worn or damaged	Grind or replace Replace
Disc brake anti-squeak shims fatigued	Adjust or replace
Front hub bearings loose or preload is incorrect Brake disc or drum rusted	Grind or replace
	Grind of replace
Brake Pull	Adime
Tire inflation pressures unequal	Adjust
Front wheel alignment incorrect	Adjust Clean or replace
Water or oil on brake pads or linings	Replace
Brake pads or linings hardened	Replace
Brake pads or linings worn excessively Brake drum or rotor worn or scored	Grind or replace
Front or rear wheel cylinder or disc brake caliper malfunctioning	Clean or replace
Front hub bearing preload incorrect	Adjust or replace
Brake pad or lining clearances unequal	Adjust or replace
Brake Drag	
Parking brake maladjusted	Adjust
Brake pad or lining clearance insufficient	Adjust
Brake pedal free play insufficient	Adjust brake pedal height or power
brake pedar free play modificant	cylinder operating rod
Piston in master cylinder sticking	Clean or replace
Pistons in disc brake caliper sticking	Replace piston seals
Pistons in rear brake wheel cylinders sticking	Clean or replace
Brake pads sticking in caliper	Clean
Return springs weakened	Replace
Parking brake binding	Overhaul rear brakes
Front hub bearing preload incorrect	Adjust or replace
Rear brake shoes not returning	Correct or replace brake back plate,
	check automatic adjuster and replace
	as necessary
Obstructions in hydraulic circuit	Clean
Rotor warped excessively	Grind or replace
Rear brake drum distorted	Grind or replace
Piston cups swollen	Replace brake fluid and piston cups
Check valve ; vacuum hose faulty	Replace
Parking cable sticking	Clean or replace
Rear disc brake over adjust	Adjust or overhaul rear brakes
Excessive Brake Pedal Travel	
Air in hydraulic circuit	Bleed hydraulic circuit
Level of brake fluid in reservoir too low	Replenish brake fluid reservoir to
	specified level and bleed hydraulic
	circuit as necessary.
Master cylinder push rod clearance excessive	Adjust
Leakage in hydraulic system	Correct or replace defective parts
Rear disc brake autoadjuster malfunction	Overhaul rear brakes

# ISUZU<br/>KB-SERIES

# **WORKSHOP MANUAL**

**SECTION 6** 

DIESEL ENGINE DIAGNOSIS

# ISUZU<br/>KB - SERIES

# **WORKSHOP MANUAL**

**SECTION 6** 

DIESEL ENGINE DIAGNOSIS

# SECTION 6 TROUBLESHOOTING

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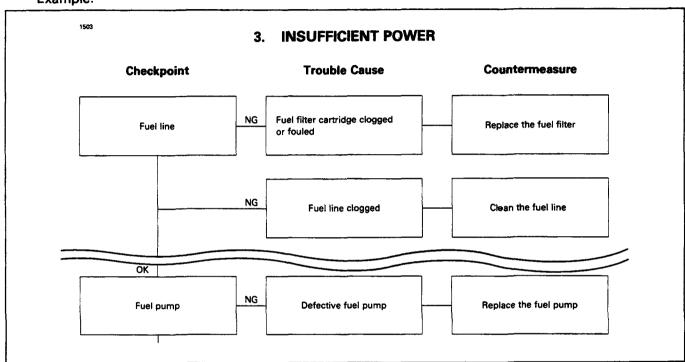
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#### 6-2 TROUBLESHOOTING

Refer to the following troubleshooting charts to quickly pinpoint and repair engine problems.

- 1. This Section is divided into ten Sub-Sections.
  - Refer to the Table of Contents.
- 2. Each troubleshooting chart has three headings arranged from left to right.

Example:



- 3. Easily checked areas are presented at the beginning of the troubleshooting chart. Procedures become more complex as the chart progresses.
- It is suggested that you work from the beginning of the troubleshooting chart. Do not start from the middle.
- 5. It is possible that a seemingly apparent engine problem is not related to the engine.

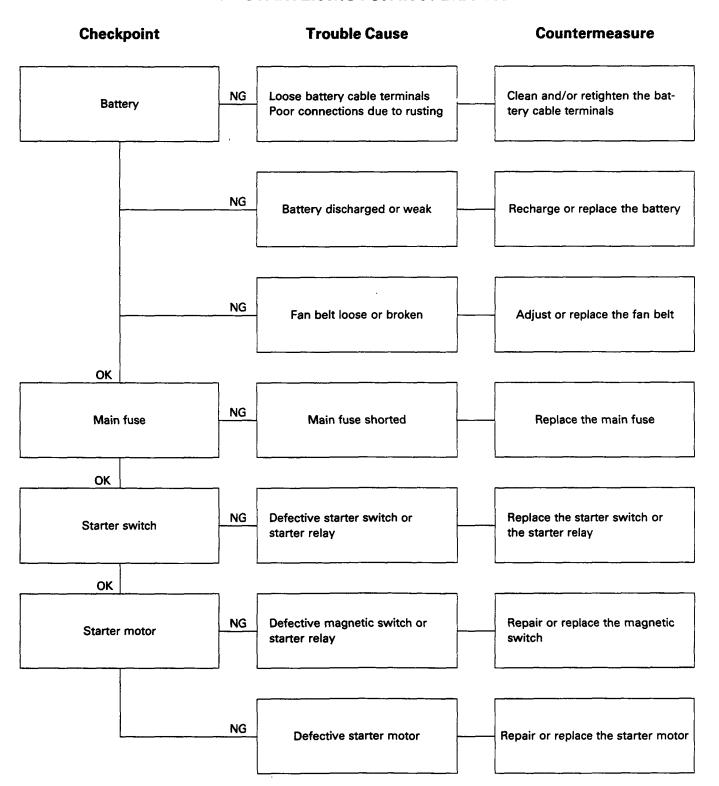
For example, the engine may appear to have insufficient power. This could be caused by dragging brakes or a slipping clutch instead of an engine malfunction.

- Refer to the other troubleshooting charts if required.
- 6. Optional equipment and variations are included in the troubleshooting charts.

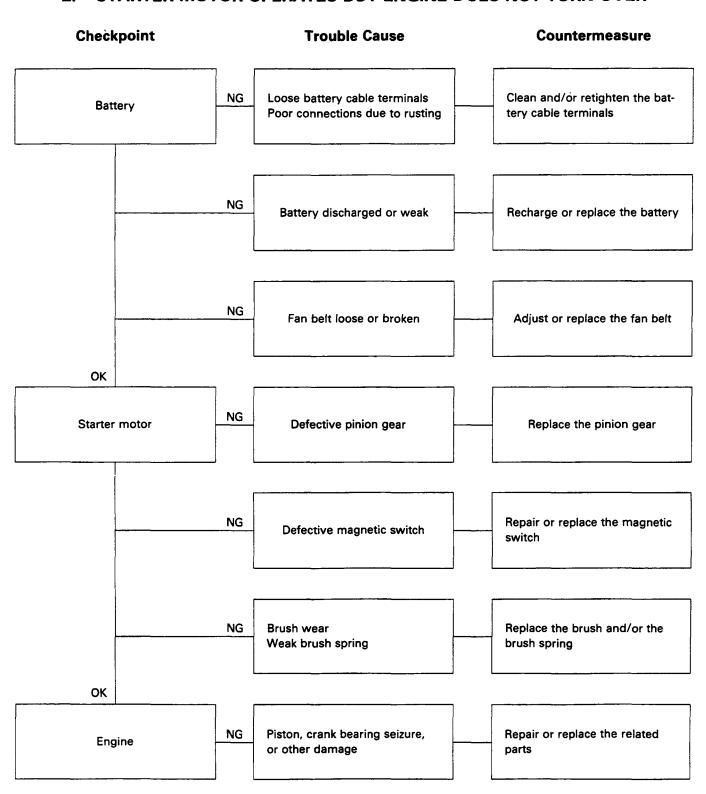
If the vehicle you are servicing is not equipped with a particular option or variation noted in the "Checkpoint" frame, disregard the frame and move on to the next one.

#### 1. HARD STARTING

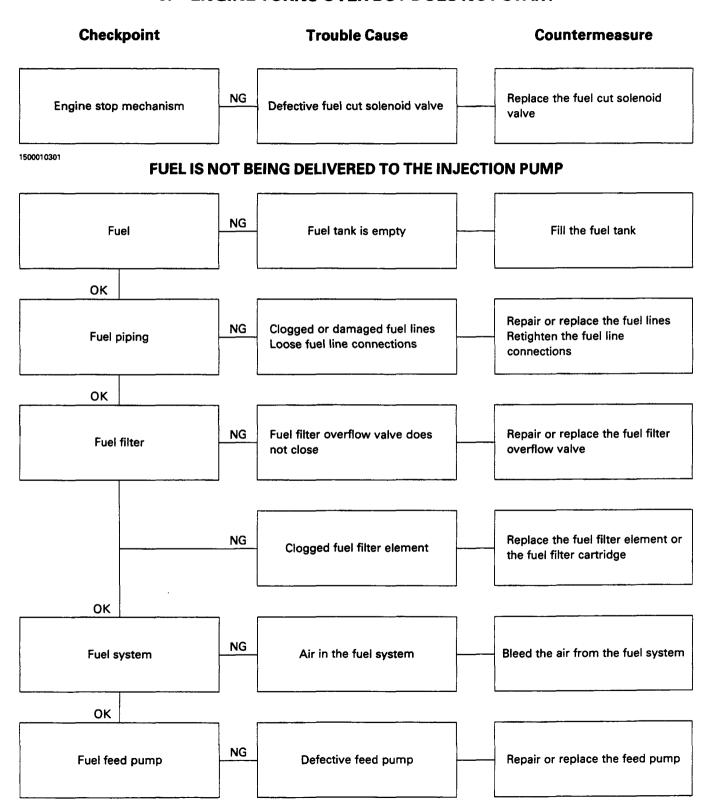
#### 1. STARTER MOTOR INOPERATIVE



#### 2. STARTER MOTOR OPERATES BUT ENGINE DOES NOT TURN OVER

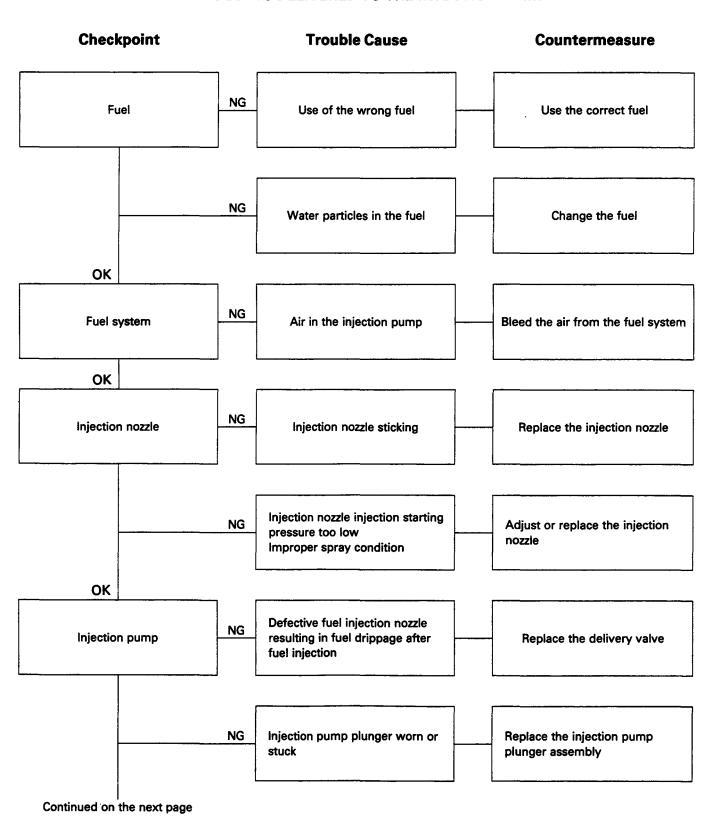


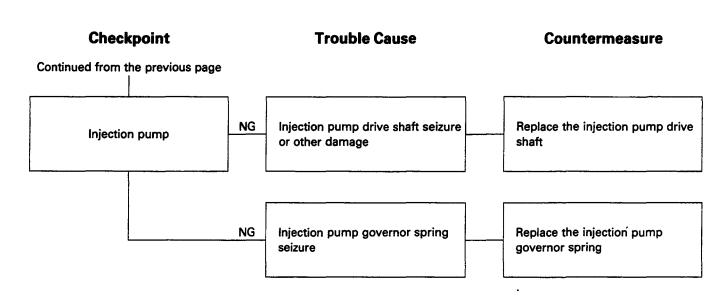
#### 3. ENGINE TURNS OVER BUT DOES NOT START



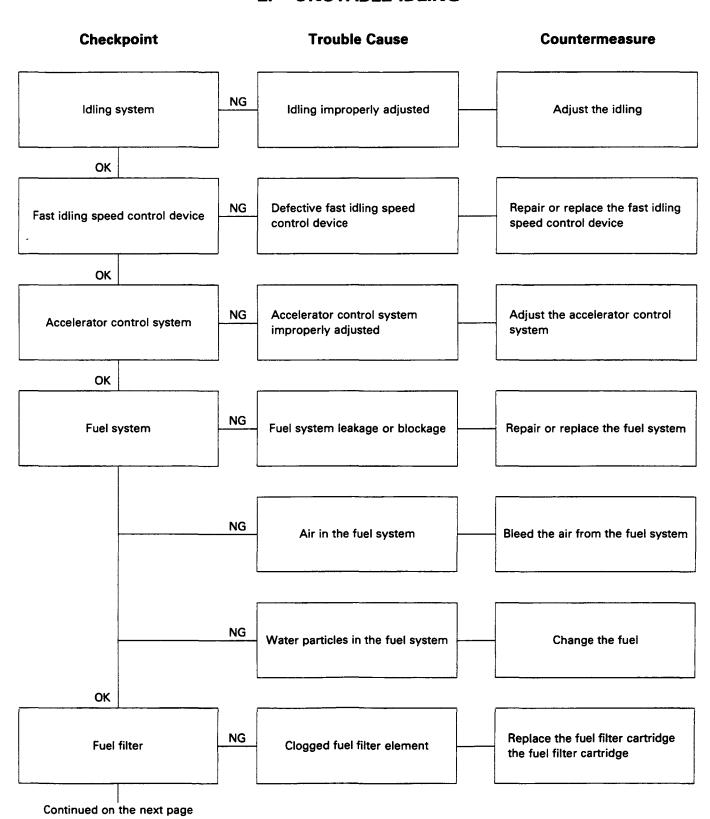
1500010302

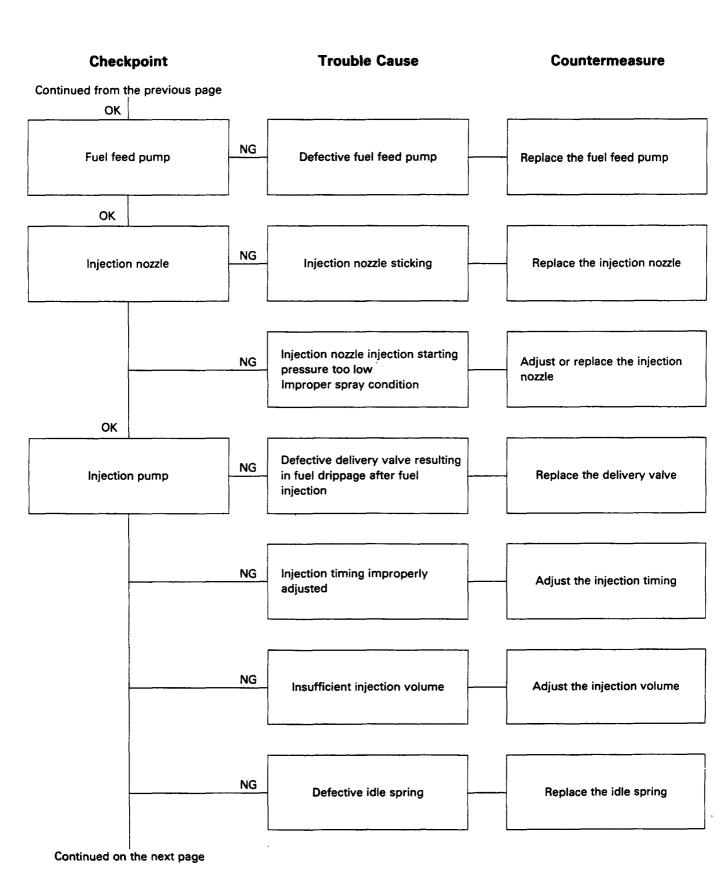
#### FUEL IS BEING DELIVERED TO THE INJECTION PUMP

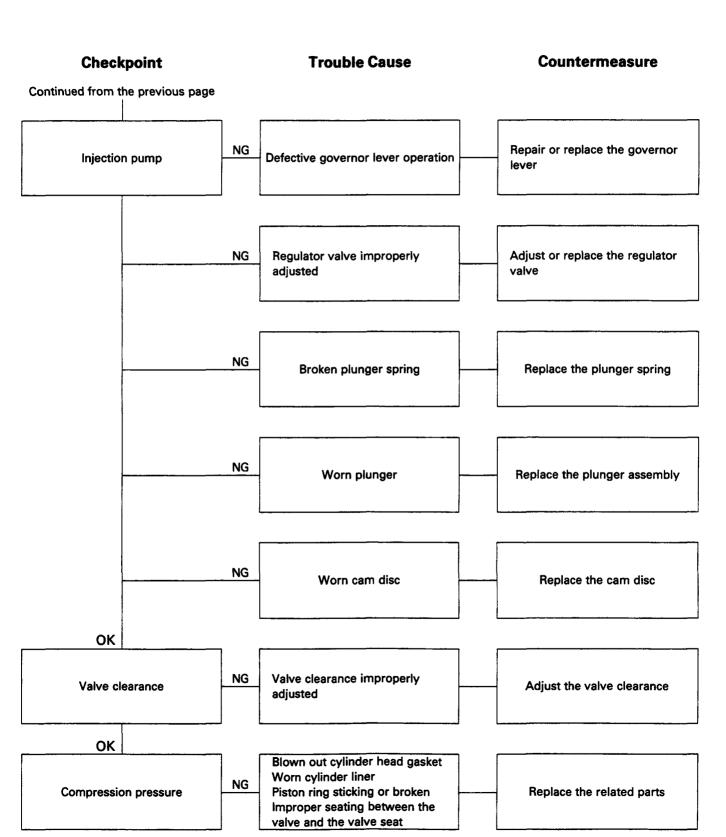




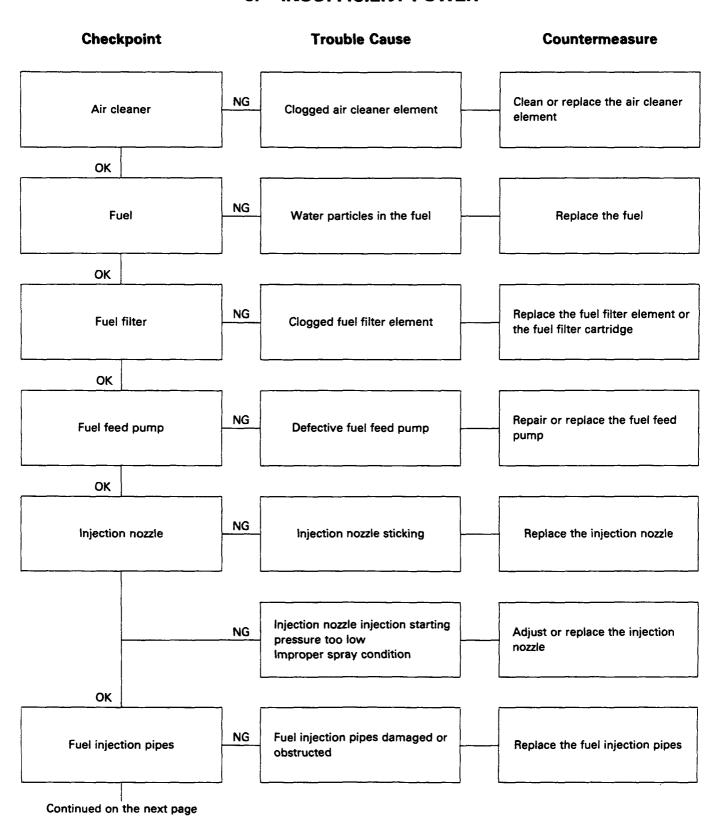
#### 2. UNSTABLE IDLING

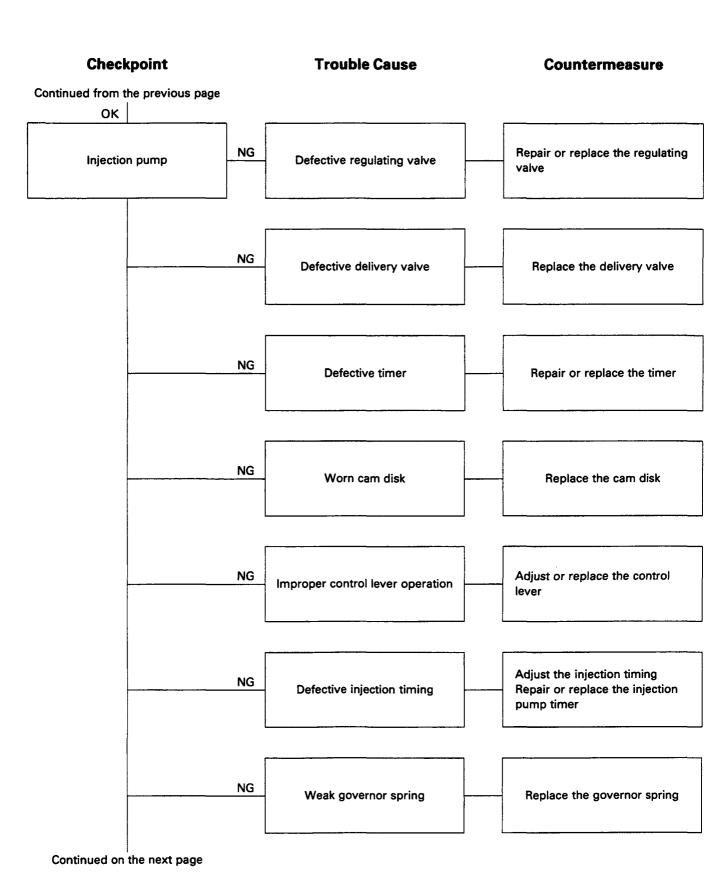


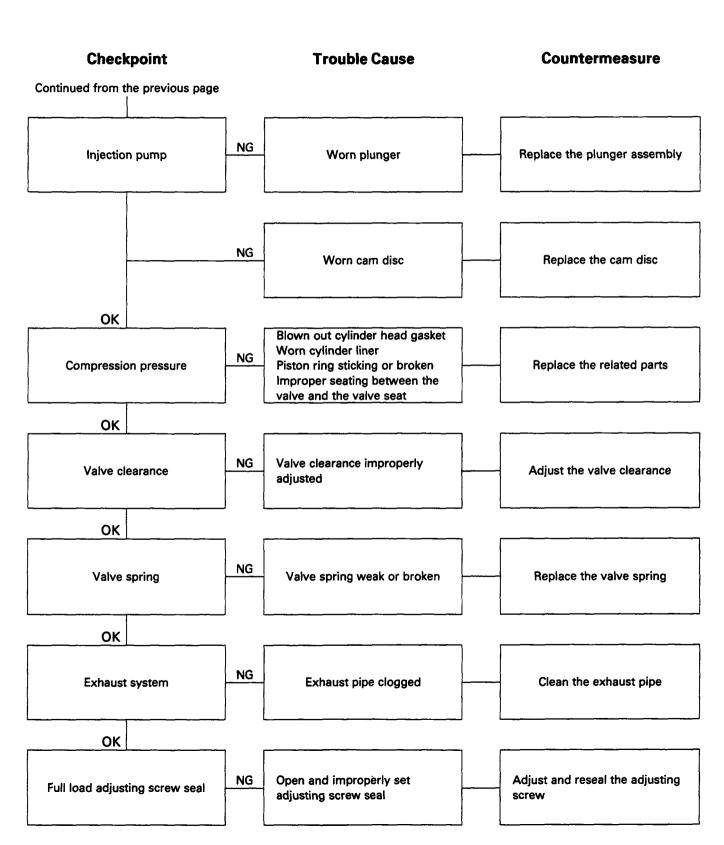




#### 3. INSUFFICIENT POWER

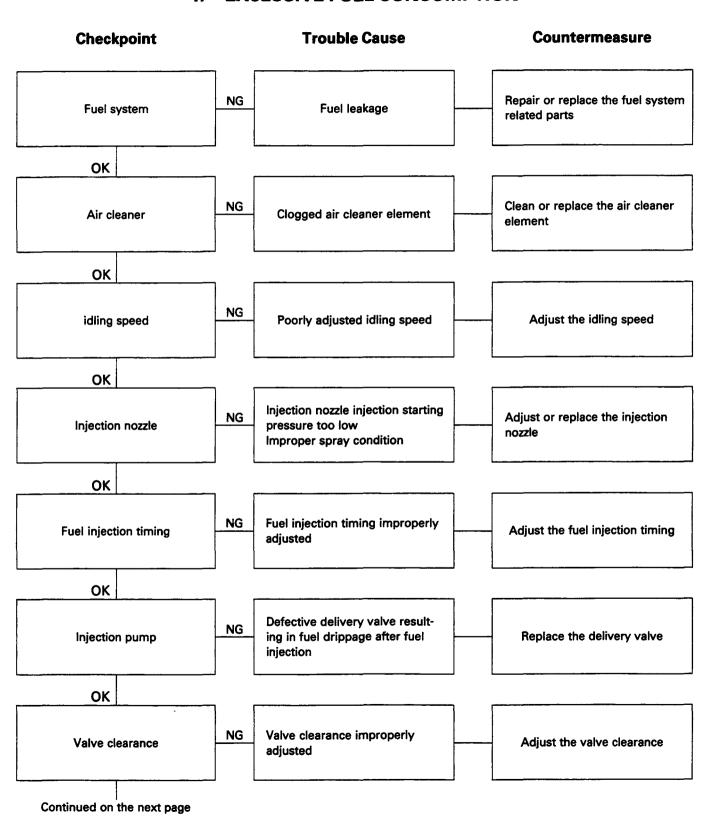


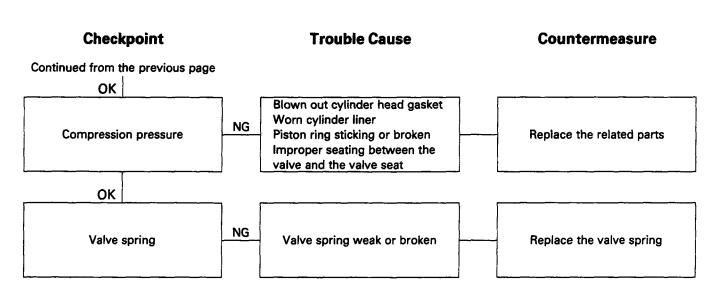




1504

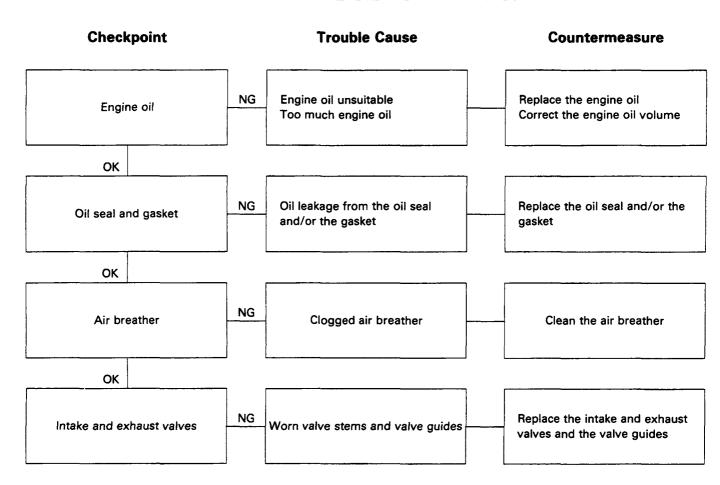
#### 4. EXCESSIVE FUEL CONSUMPTION



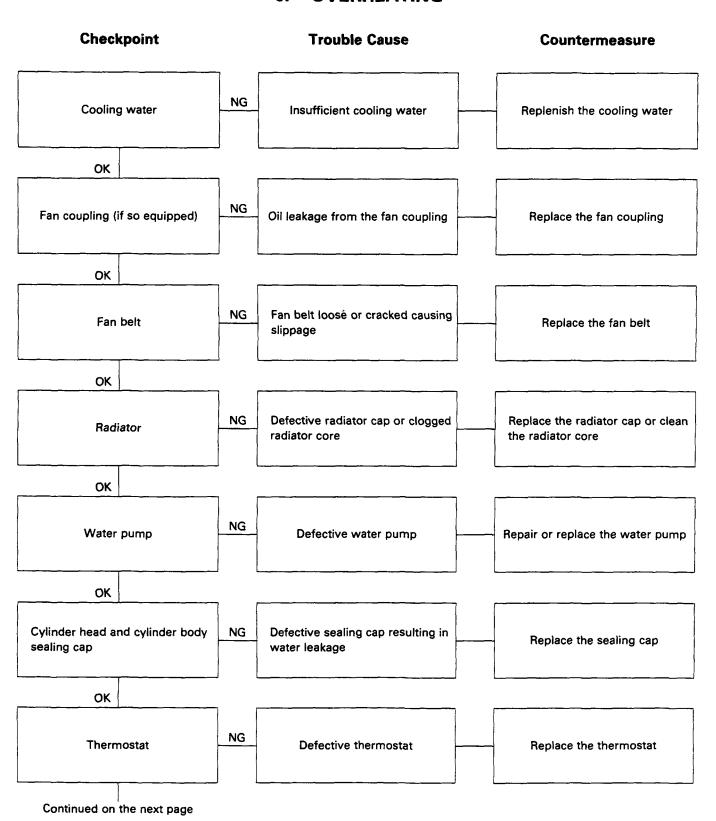


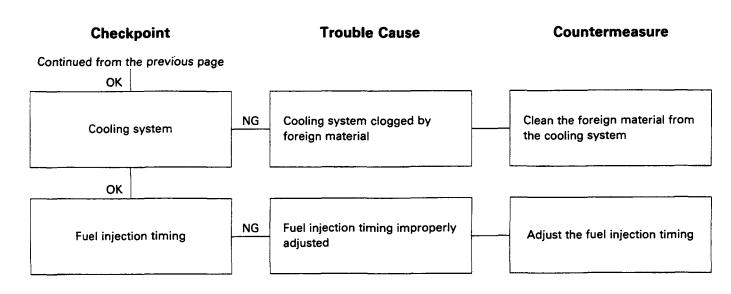
1505

#### 5. EXCESSIVE OIL CONSUMPTION

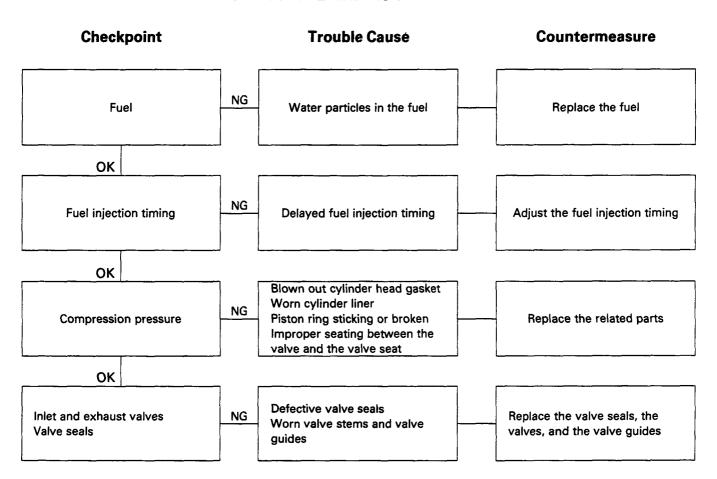


#### 6. OVERHEATING



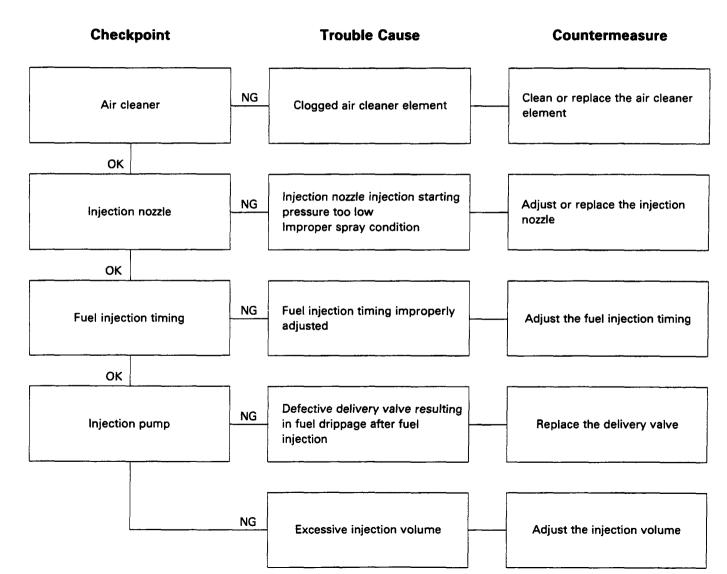


#### 7. WHITE EXHAUST SMOKE

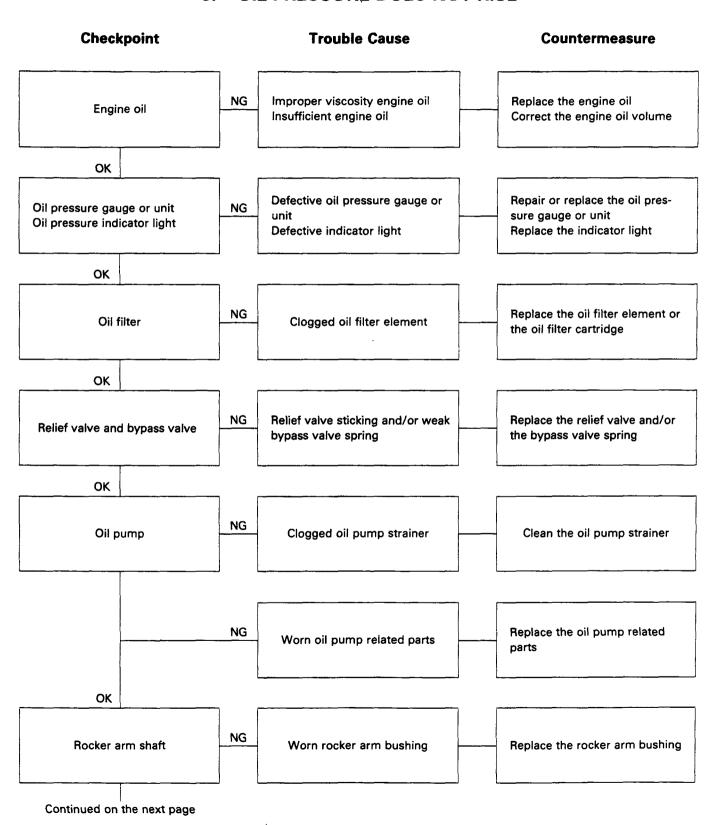


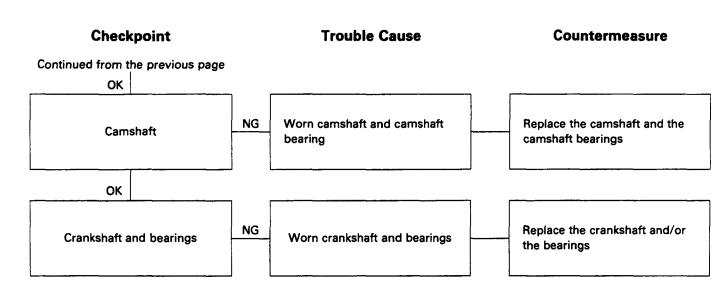
1508

# 8. DARK EXHAUST SMOKE



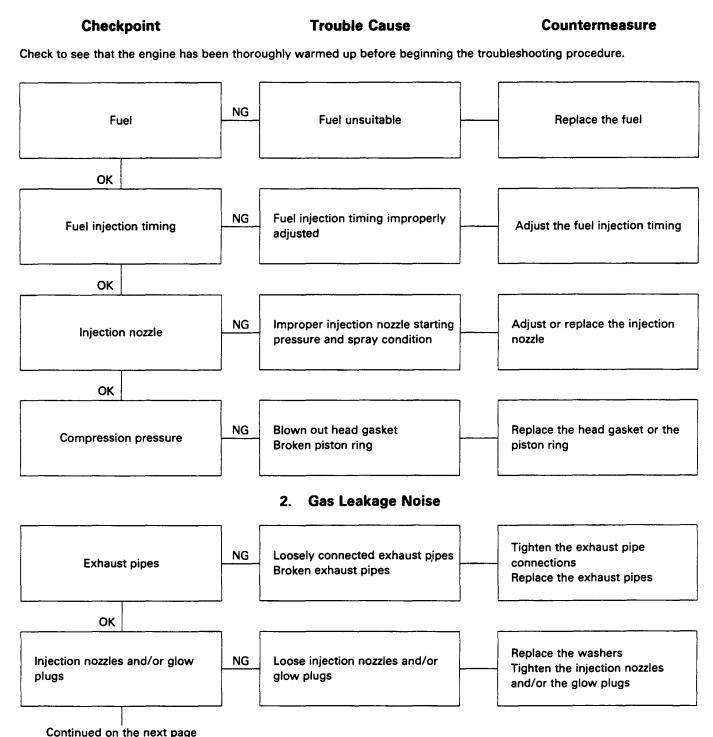
# 9. OIL PRESSURE DOES NOT RISE





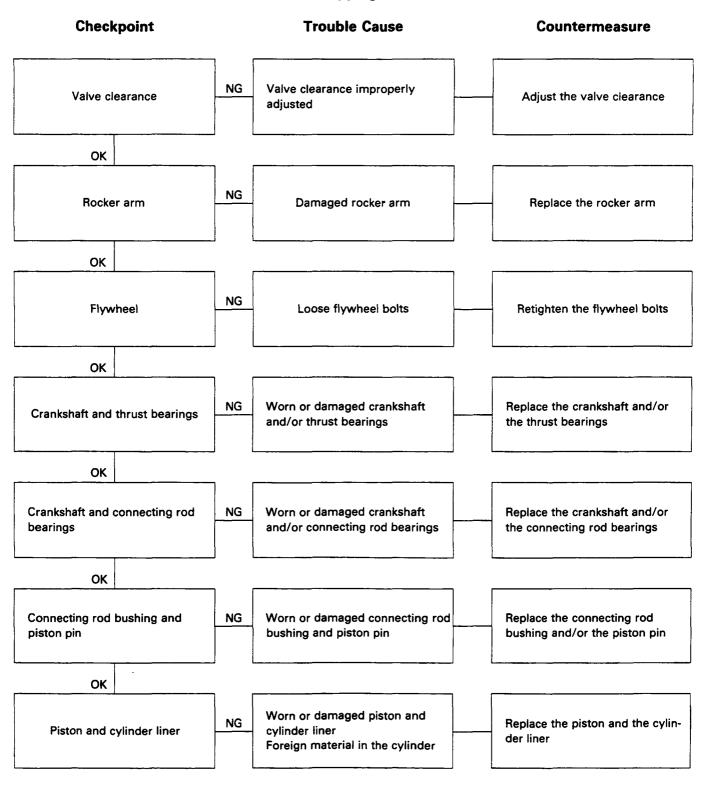
### 10. ABNORMAL ENGINE NOISE

## 1. Engine Knocking

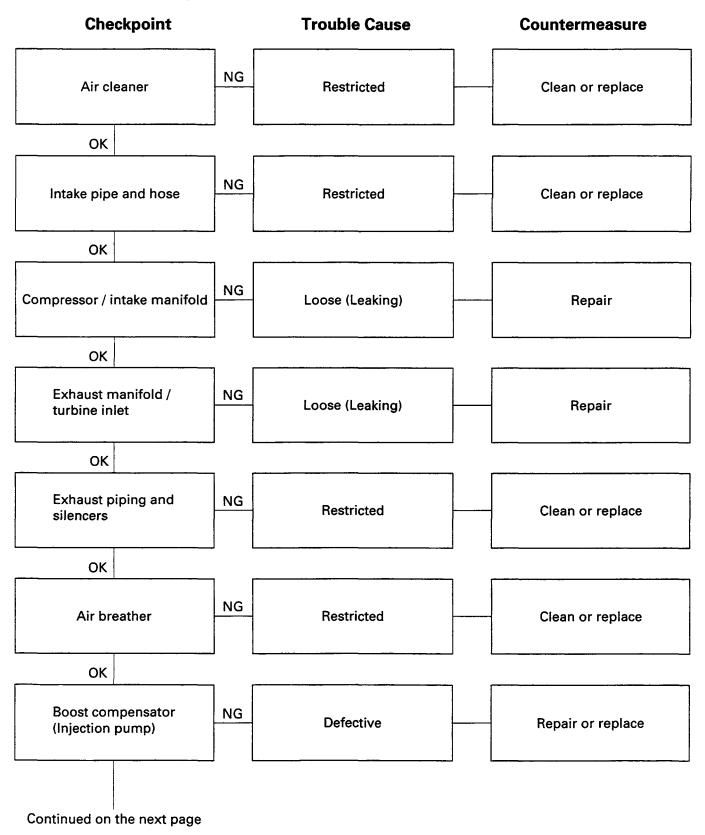


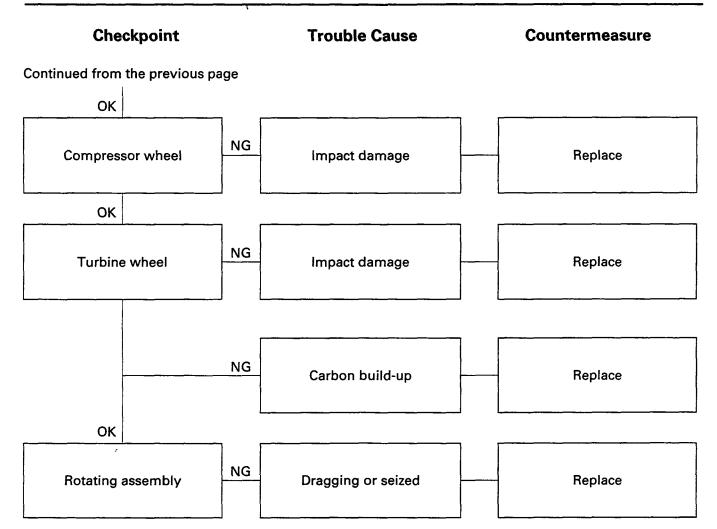
# Gas Leakage Noise 2. **Trouble Cause** Countermeasure Checkpoint Continued from the previous page OK NG Loosely connected exhaust mani-Tighten the exhaust manifold Exhaust manifold fold and/or glow plugs connections OK NG Replace the cylinder head gasket Cylinder head gasket Damaged cylinder head gasket 3. Continuous Noise NG Fan belt Loose fan belt Readjust the fan belt tension OK NG Retighten the cooling fan Cooling fan Loose cooling fan OK NG Worn or damaged water pump Water pump bearing Replace the water pump bearing bearing OK NG Defective alternator or vacuum Repair or replace the alternator Alternator or vacuum pump or the vacuum pump pump OK NG Valve clearance improperly Valve clearance Adjust the valve clearance adjusted

#### 4. Slapping Noise

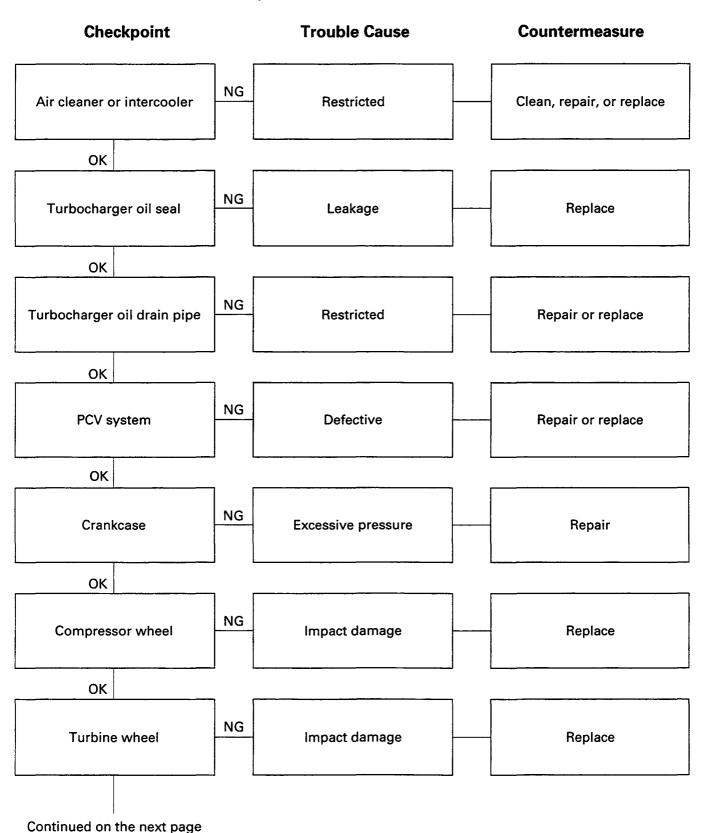


# Turbocharger 1) ENGINE HAS LESS THAN NORMAL POWER



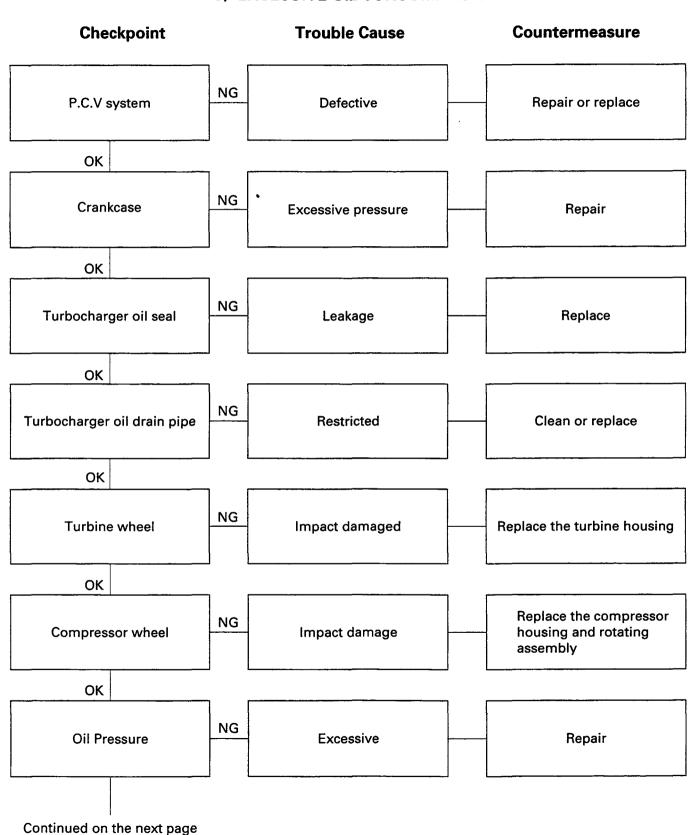


#### 2) BLUE OR BLACK SMOKE



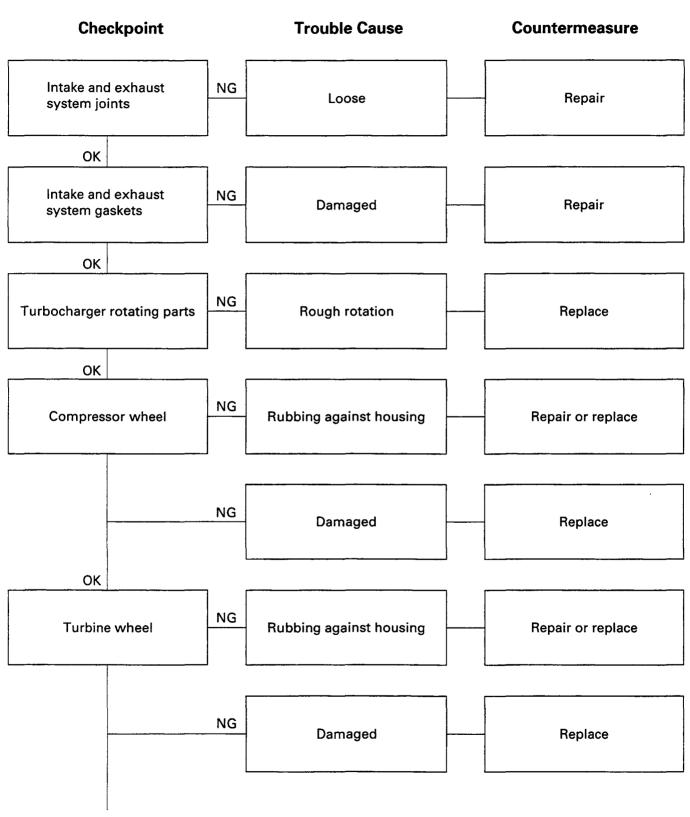
Checkpoint	S	Trouble Cause	Countermeasure
Continued from the previous pa	age		
Center housing oil drain passage	NG	Restricted	Clean or replace

## 3) EXCESSIVE OIL CONSUMPTION

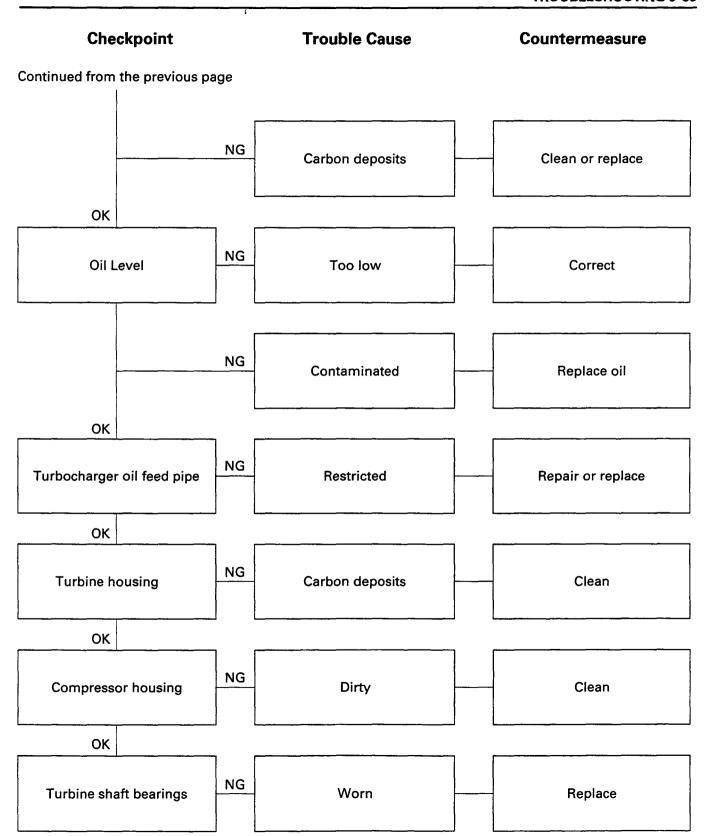


***				 IKOORTE2HOOJING 9-3
Checkpe	oint		Trouble Cause	Countermeasure
Continued from the p	previous p	age		
Center housing passage	oil drain	NG	Restricted	Clean or replace

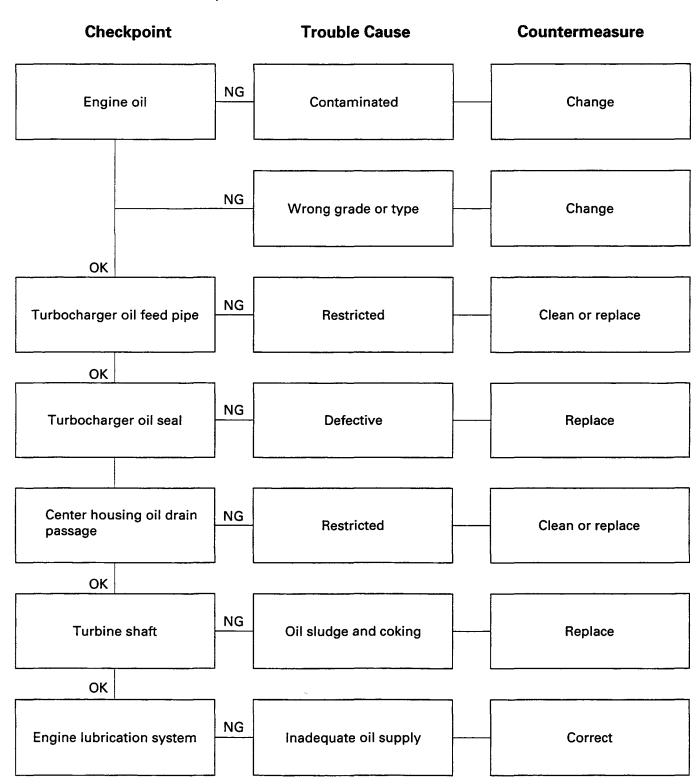
# 4) EXCESSIVE TURBOCHARGER NOISE



Continued on the next page



## 5) EXCESSIVE ROTATING PART WEAR











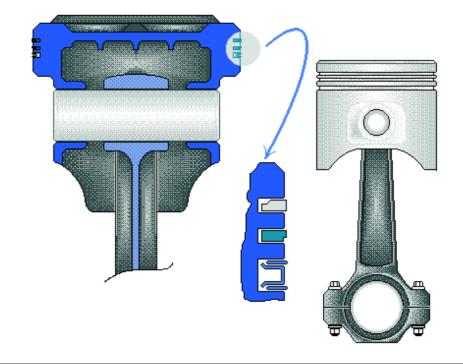


Specs.

Servicing

Overhaul

Lubrication



# KB TF 140 Diesel Engine

# **SECTION 6A**

# **ENGINE MECHANICAL**

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General Description		
Oil Pump		
Oil Filter and Oil Cooler		

# MAIN DATA AND SPECIFICATIONS

Engine model			4JA1	4JB1T
ltem			4JA I	43571
Engine type			Four-cycle, overhead	l valve, water cooled
Combustion char	mber type		Direct in	njection
Cylinder liner typ	e		Dry type, chrome plate	ed, stainless steel tube
Timing gear train	n system		Gear	drive
No. of cylinders -	-bore × stroke	mm(in)	4 – 93 × 92 (3.66 × 3.62)	4 – 93 × 102 (3.66 × 4.02)
No. of piston ring	gs		Compression rir	ng: 2 / Oil ring: 1
Total piston disp	lacement	cm³(in³)	2,499 (152.4)	2,771 (169.0)
Compression rati	io (to 1)		18.5	18.1
Compression pre	essure kg/cm²(	psi/kPa)	31 (441/3)	– 200 rpm
Engine weight		kg(lb)	Approximately 226 (498)	Approximately 250 (550)
Fuel injection ord	der	_	1 – 3 -	- 4 – 2
Fuel injection tim	ning BTDC	deg	12	11
Specified fuel typ	oe .	_	SAE No. 2	diesel fuel
Idling speed		rpm	75	50
Valve clearances	(At cold): Intake	mm(in)	0.4 (0.016)	
	Exhaust	mm(in)	0.4 (0.016)	
Intake valves	Open at (BTDC)	deg	24	J.5
	Close at (ABDC)	deg	55	5.5
Exhaust valves	Open at (BBDC)	deg	54	.0
	Close at (ATDC)	deg	26	5.0
Fuel system		;		
Injection pump	type		BOSCH distributor VE type	
Governor type			Mechanical (Variable speed)	Mechanical (Limit speed)
Injection nozzle	type		Hole with 5 orifices	
Injection nozzle opening kg/cm²(psi/kPa) pressure (Design value)		185 (2,631/18,143)		
Single spring	type			
Main fuel filter type		Cartridge paper eleme	nt and water separator	
Lubricating system				
Lubricating method		Pressure o	circulation	
Specified engine oil (API grade)		CC or CD	CD	
Oil pump type		Gear		
Oil filter type		Cartridge paper element		
Oil capacity (When engine lit(US/UK gal) dry)		6.5 (1.7/1.43)		
Oil cooler type			Water cooled	

4JB1T: 4JB1 Engine with turbocharger.

Eng	gine model	4JA1	4JB1T
Item			70011
Cooling system			
Water pump type		Cent	trifugal
Thermostat type		Wax pellet w	vith jiggle valve
Air cleaner type	}	Dry paper element	
Battery type/voltage $\times$ No. of un	its	95D31R-12×1	
Alternator capacity	V-A (Kw)	12 – 40 (480)	12 – 50 (600)
Starter motor output	V-Kw	12	- 2.0
Turbocharger model			*IHI RHF4H
Turbine type			Radial-inflow
Compressor type			Radial-outflow
Maximum permissible speed	rpm		172,000

<sup>\*</sup>IHI : Ishikawajima-Harima Heavy Industries., Ltd.

# TORQUE SPECIFICATION



# STANDARD BOLTS

The torque values given in the following table should be applied whenever a particular torque is not specified.

kg·m(lb.ft/N·m) Strength 4.8 (4T) 9.8 (9T) (7T) 8.8 Class Non-Refined Refined **Bolt Identification Bolt** No mark **Diameter**× Pitch (mm)  $0.60 \pm 0.20$  $0.75 \pm 0.25$ M  $6 \times 1.0$  $(4.33 \pm 1.44/5.88 \pm 1.96)$  $(5.43\pm1.80/7.35\pm2.45)$  $1.30 \pm 0.50$ 1.75±0.55 M 8 × 1.25  $2.40 \pm 0.70$  $(9.40\pm3.62/12.74\pm4.90)$  $(12.66 \pm 4.00/17.15 \pm 5.39)$  $(17.36\pm5.06/23.52\pm6.86)$ 3.75±0.95 M10 × 1.25  $2.80 \pm 0.70$  $5.10 \pm 1.30$  $(20.25\pm5.06/27.44\pm6.86)$  $(27.12\pm6.87/36.75\pm9.31)$  $(36.89\pm9.40/49.98\pm12.74)$ M12 × 1.25  $6.25 \pm 1.25$  $7.75 \pm 1.55$ 9.65±1.95  $(56.06 \pm 11.21/75.95 \pm 15.19)$  $(45.21\pm9.04/61.25\pm12.25)$  $(69.80\pm14.10/94.57\pm19.11)$  $M14 \times 1.5$  $9.75 \pm 1.95$  $11.85 \pm 2.35$ 14.50±2.90  $(70.52 \pm 14.10/95.55 \pm 19.11)$  $(85.71 \pm 17.00/116.13 \pm 23.03)$  $(104.88 \pm 21.00/142.10 \pm 28.42)$  $M16 \times 1.5$  $13.30 \pm 2.70$  $17.30 \pm 3.50$ 20.40±4.10  $(96.20\pm19.53/130.34\pm26.46)$  $(125.13\pm25.32/169.54\pm34.30)$  $(147.55\pm29.66/199.92\pm40.18)$ M18 × 1.5 19.20 + 3.8024.90 ± 5.00  $29.30 \pm 5.90$  $(138.87 \pm 27.49/188.16 \pm 37.24)$  $(180.10 \pm 36.17/244.02 \pm 49.00)$  $(211.93\pm42.67/287.14\pm57.82)$ M20 × 1.5  $34.40 \pm 6.90$ 26.30+5.30 40.40±8.10  $(248.82 \pm 49.41/337.12 \pm 67.62)$  $(190.23\pm38.33/257.74\pm51.94)$  $(292.21 \pm 58.59/395.92 \pm 79.38)$ M22 × 1.5 46.25+9.25 33.90±8.30 54.10±10.80  $(245.20\pm60.03/332.22\pm81.34)$  $(334.53\pm66.91/453.25\pm90.65)$  $(391.30 \pm 78.12/530.18 \pm 105.84)$  $M24 \times 2.0$ 45.80±9.20 58.20±14.30 70.60±14.10  $(331.27 \pm 66.54/448.84 \pm 90.16)$  $(420.96 \pm 103.43/570.36 \pm 140.14)$  $(510.65\pm101.99/691.88\pm138.18)$ \*M10 × 1.5  $2.70 \pm 0.70$  $3.70 \pm 0.90$  $4.90 \pm 1.20$  $(19.53\pm5.06/26.46\pm6.86)$  $(26.76\pm6.50/36.26\pm8.82)$  $(35.44 \pm 8.68/48.02 \pm 11.76)$ \*M12 × 1.5  $5.80 \pm 1.20$  $7.20 \pm 1.40$ 9.10 + 1.80 $(41.95\pm8.68/56.84\pm11.76)$  $(52.08\pm10.13/70.56\pm13.72)$  $(65.82 \pm 13.02/89.18 \pm 17.64)$ \*M14 × 2.0  $9.10 \pm 1.80$ 11.20 ± 2.20  $13.60 \pm 2.70$  $(65.82 \pm 13.02/89.18 \pm 17.64)$  $(81.01 \pm 15.91/109.76 \pm 21.56)$  $(98.37 \pm 19.53/133.28 \pm 26.46)$ \*M16 × 2.0  $12.70 \pm 2.50$ 16.50 + 3.30 $19.50 \pm 3.90$  $(91.86 \pm 18.08/124.46 \pm 24.50)$  $(119.34 \pm 23.87/161.70 \pm 32.34)$  $(141.04\pm28.21/191.10\pm38.22)$ 

An asterisk (\*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting. Those shown in parentheses in the strength class indicate the classification by the old standard.



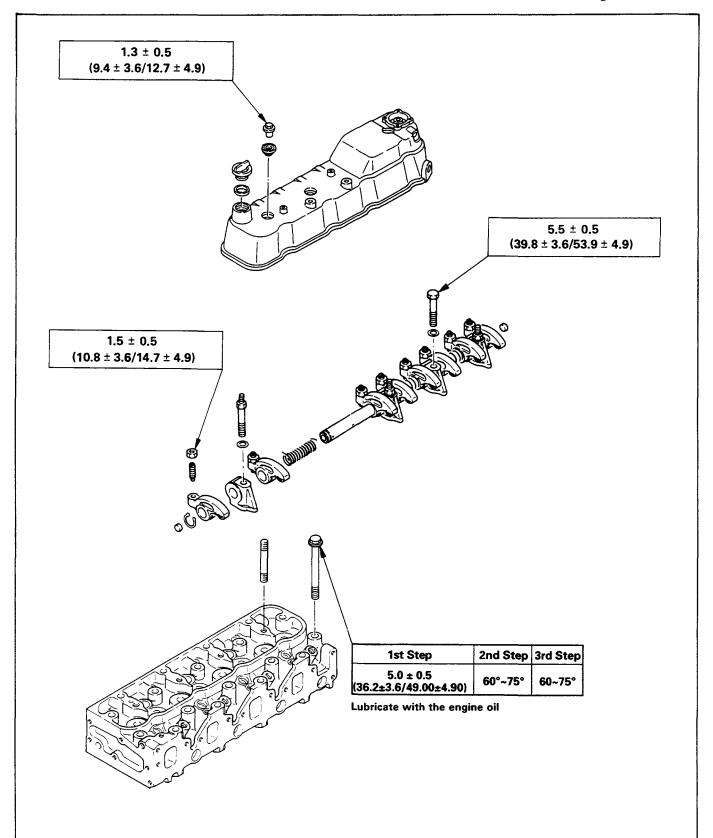
# **FLARE NUTS**

Pipe diameter mm(in)	Torque	Pipe diameter mm(in)	Torque
4.76 (0.187)	1.55±0.25 (11.2± 1.8/15.2±2.45)	10.00 (0.394)	5.50±0.5 (39.7±3.6/53.95±4.90)
6.35 (0.250)	2.70±0.30 (19.5±2.1/26.48±2.94)	12.00 (0.472)	9.00±1.0 (65.0±7.2/88.29±9.80)
8.00 (0.315)	4.50±0.50 (32.5±3.6/44.14±4.90)	15.00 (0.591)	10.75±1.25 (77.7±9.0/105.45±12.26)



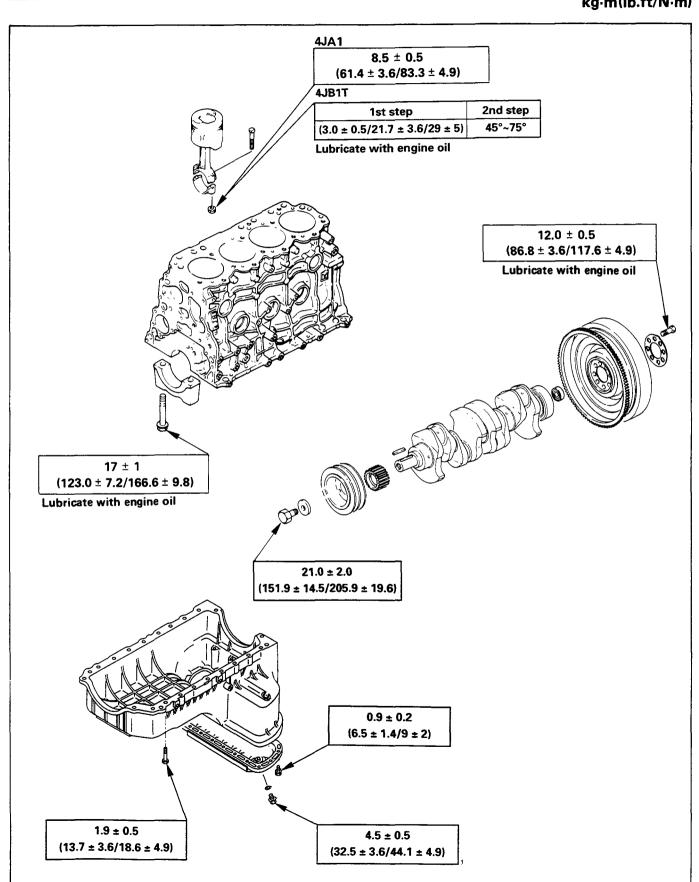
# **SPECIAL PARTS FIXING NUTS AND BOLTS**

Cylinder Head Cover, Cylinder Head, and Rocker Arm Shaft Bracket





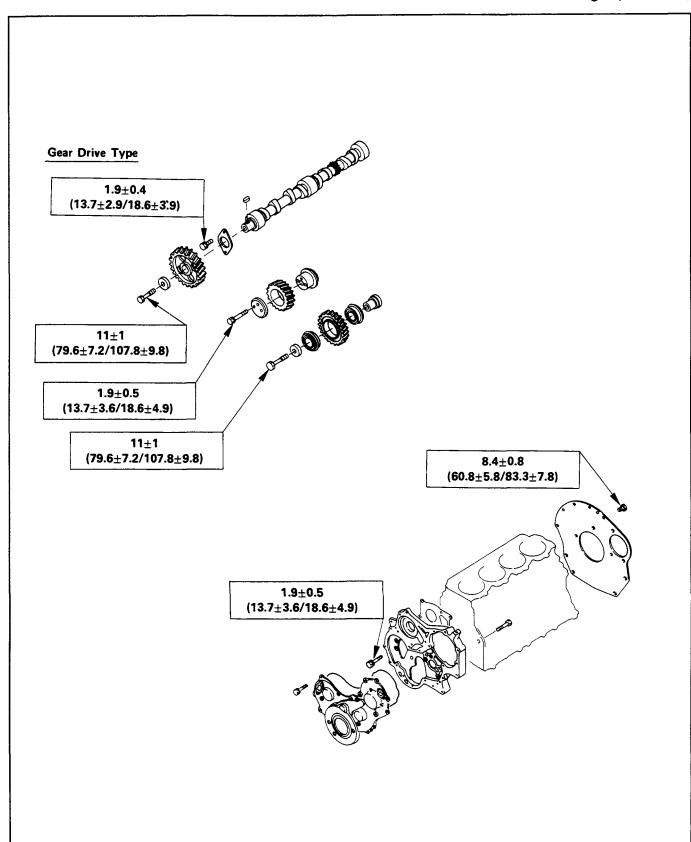
Crankshaft Bearing Cap, Connecting Rod Bearing Cap, Crankshaft Damper Pulley, Flywheel, and Oil Pan





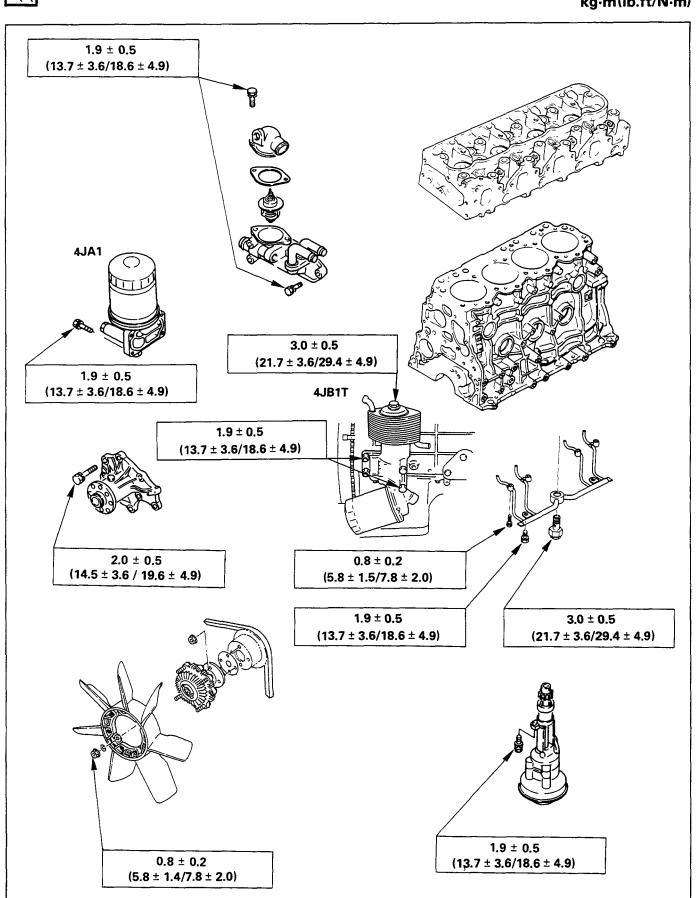
Timing Gear Case, Pulley Housing, Timing Gear, and Camshaft

 $kg \cdot m(lb.ft/N \cdot m)$ 

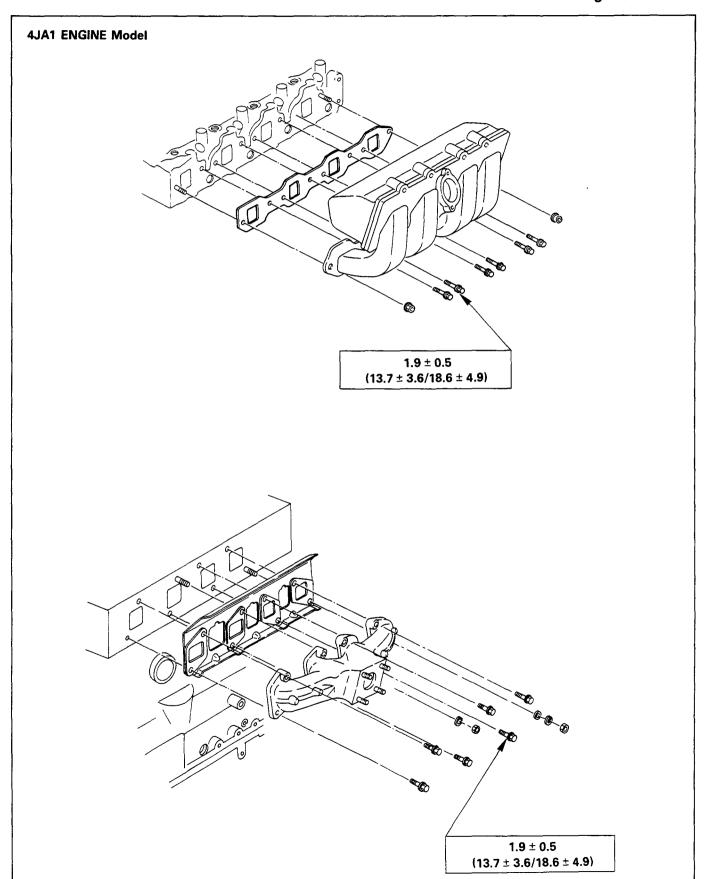




# **Cooling and Lubricating System**

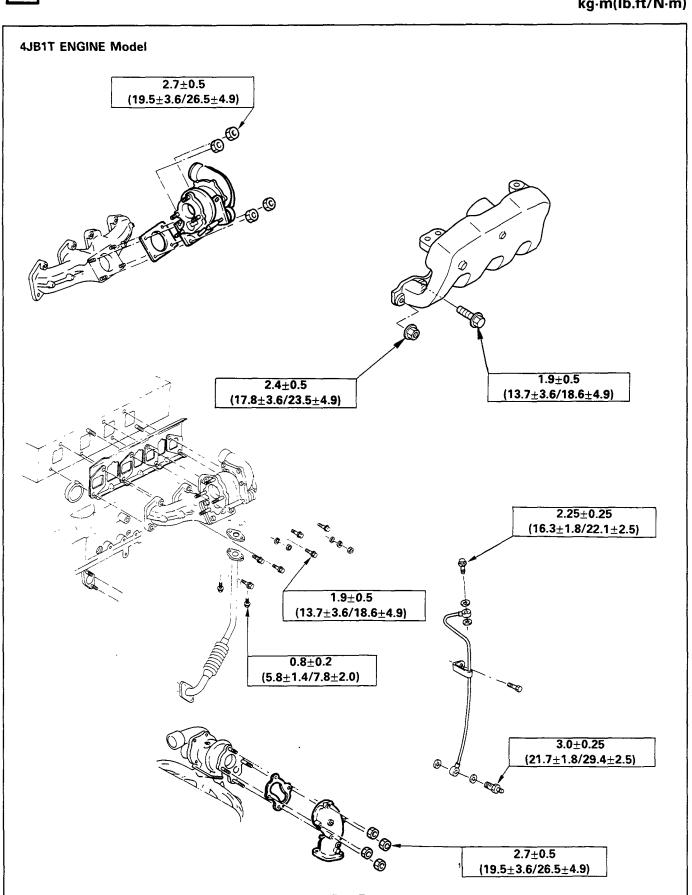


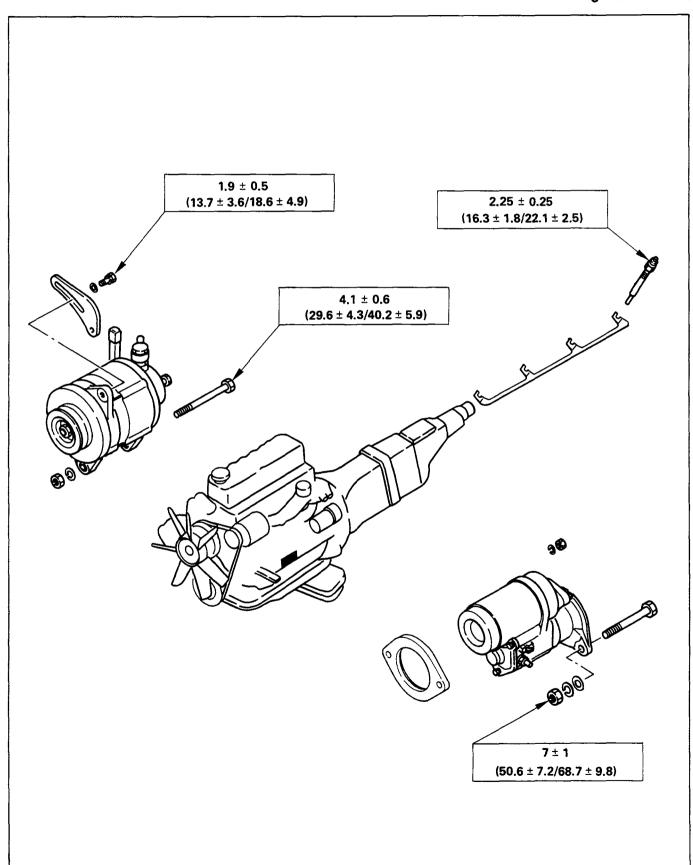
# **Intake and Exhaust Manifold**

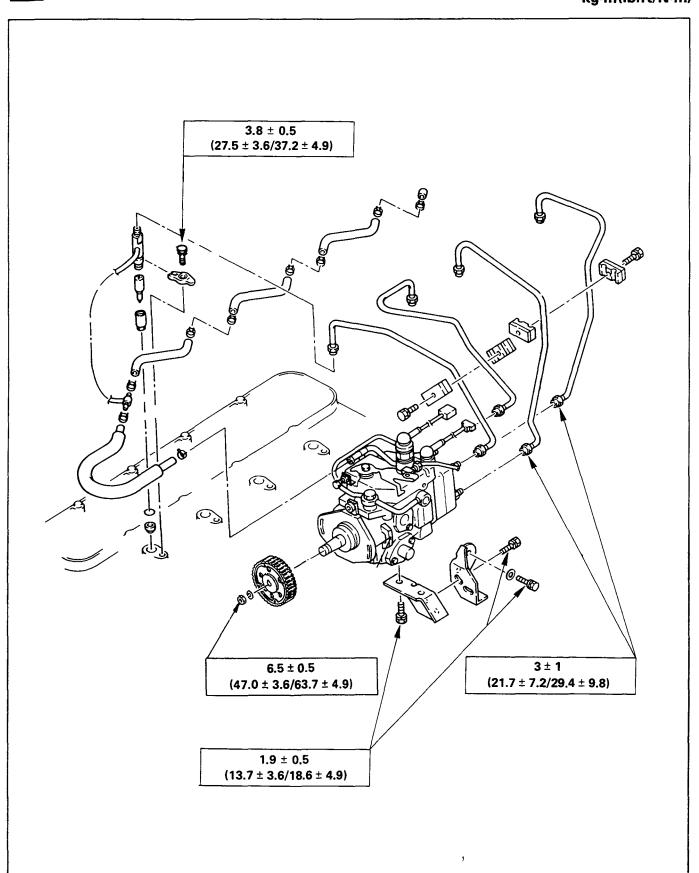




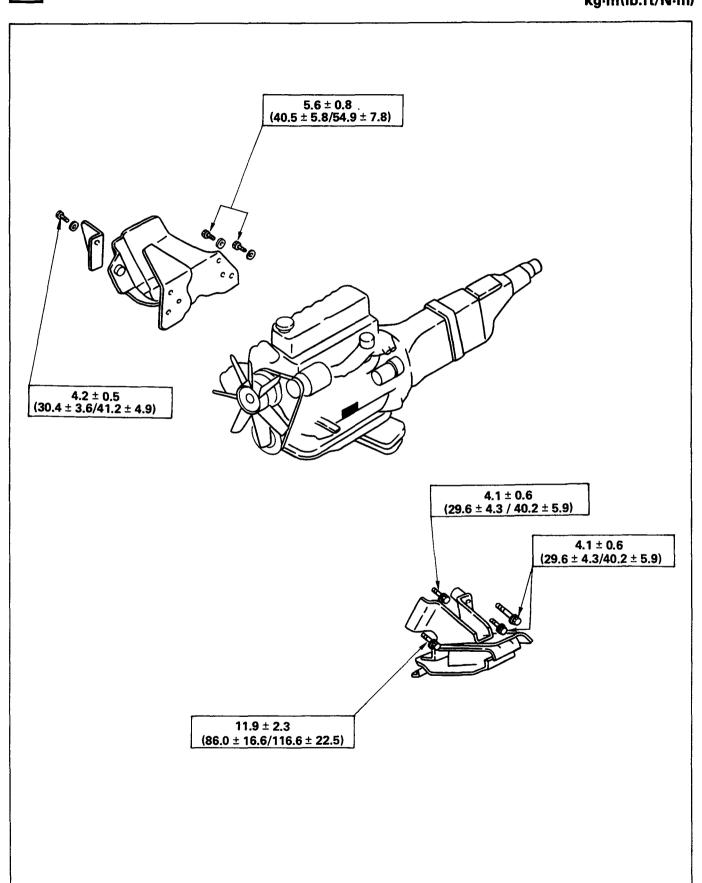
# Intake Manifold, Exhaust Manifold, and Turbocharger







# **Engine Mounting Bracket**



# RECOMMENDED LIQUID GASKET

Туре	Brand Name	Manufacturer	Remarks
RTV*	ThreeBond 1207B	Three Bond	
Silicon Base	ThreeBond 1207C	Three Bond	
Water Base	ThreeBond 1141E	Three Bond	
	ThreeBond 1104	Three Bond	
Cabaant	BelcoBond 4	Isuzu	
Solvent	BelcoBond 401	Isuzu	
	BelcoBond 402	Isuzu	
A =====bi=	LOCTITE 515	Loctite	Recommended for
Anaerobic	LOCTITE 518	Loctite	transaxle repairs

<sup>\*</sup> RTV : Room Temperature Vulcanizer

#### Note:

- 1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
- 2. Be careful to use the specified amount of liquid gasket. Follow the manufacturer's instructions at all times.
- 3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.

The connecting surfaces must be perfectly dry.

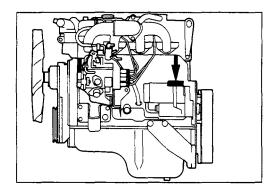
- 4. LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.
  - Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.

# LOCTITE APPLICATION PROCEDURE

LOCTITE Type	LOCTITE Color	Application Steps
LOCTITE 242	Blue	<ol> <li>Completely remove all lubricant and moisture from the bolts and the female threaded surfaces of the parts to be joined.         The surfaces must be perfectly dry.     </li> <li>Apply LOCTITE to the bolts.</li> </ol>
LOCTITE 262	Red	Apply LOCTITE to at least 1/3 of the bolt's threaded area.
LOCTITE 270	Green	<ol> <li>Tighten the bolts to the specified torque.</li> <li>Wait at least one hour before continuing the installation procedure.</li> </ol>
LOCTITE 271	Red	
LOCTITE 515	Violet	<ol> <li>Completely remove lubricant and moisture from the connecting surfaces.         The surfaces must be perfectly dry.</li> <li>Apply a 2.0 — 2.5 mm bead of LOCTITE to one of the connecting surfaces.         There must be no gaps in the bead.     </li> <li>Enlarged area         LOCTITE         Bead width 2 — 2.5 mm (0.08 = 0.10 in)         Bead width 2 mm (0.08 in)     </li> <li>Tighten the bolts to the specified torque.</li> <li>Let the joined parts set for at least thirty minutes.</li> </ol>

# **SERVICING**

Servicing refers to general maintenance procedures to be performed by qualified service personnel.



#### **MODEL IDENTIFICATION**

#### **Engine Serial Number**

The engine number is stamped on the front left hand side of the cylinder body.





#### **AIR CLEANER**

Element cleaning procedures will vary according to the condition of the element.

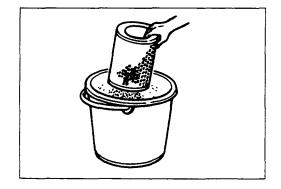
#### Oil Wetted (Viscous) Type Paper Element

The air cleaner has an oil wetted paper element. No servicing is required until the replacement interval is reached. Never attempt to clean the element, no matter how dirty may appear. The element is designed to provide normal filtering efficiency until it becomes due for replacement. Refer to the Item "Service and Maintenance" in the Owner's and Driver's Manual for general service information.

#### **Dust Fouled Element**

Rotate the element with your hand while applying compressed air to the inside of the element. This will blow the dust free.

Compressed air pressure must not exceed 7 kg/cm<sup>2</sup> (99.6 psi/686 kPa).

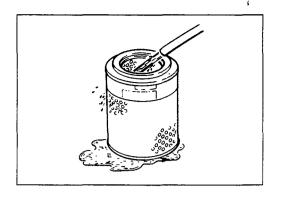




#### **Carbon and Dust Fouled Element**

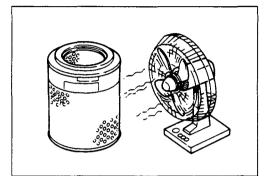
- 1. Prepare a cleaning solution of Isuzu Genuine Element Cleaner (Donaldson D1400) diluted with water.
- Submerge the element in the solution for twenty minutes.

:



3. Remove the element from the solution and rinse it well with running water.

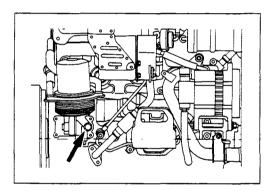
Water pressure must not exceed 2.8 kg/cm<sup>2</sup> (39.8 psi/



Dry the element in a well ventilated area.
 An electric fan will hasten drying.

#### Note:

Do not use compressed air or an open flame to dry the element quickly. Damage to the element will result. It will usually take two or three days for the element to dry completely. Therefore, it is a good idea to have a spare on hand to use in the interim.

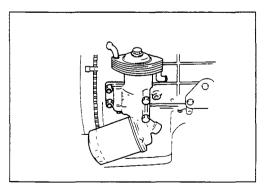




#### **LUBRICATING SYSTEM**

# Main Oil Filter (Cartridge Type Paper Element) Replacement Procedure

- Loosen the drain plug to drain the engine oil.
- 2. Wait a few minutes and then retighten the drain plug.
- 3. Loosen the used oil filter by turning it counterclockwise with a filter wrench.



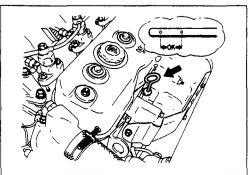


 Clean the oil cooler fitting face. This will allow the new oil filter to seat properly.



- 5. Apply a light coat of engine oil to the O-ring.
- 6. Turn in the new oil filter until the filter O-ring is fitted against the sealing face.
- 7. Use the filter wrench to turn in the filter an additional 1 and 1/8 turns.

Filter Wrench: 5-8840-0200-0





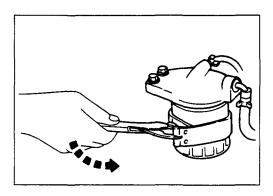
8. Check the engine oil level and replenish to the specified level if required.

Replenished Engine Oil

lit(US/UK gal)

Approx. 6.5 (1.7/1.4)

9. Start the engine and check for oil leakage from the main oil filter.



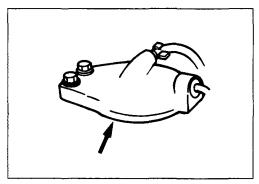


#### **FUEL SYSTEM**

#### **Fuel Filter Replacement Procedure**

1. Loosen the used fuel filter by turning it counterclockwise with the filter wrench.

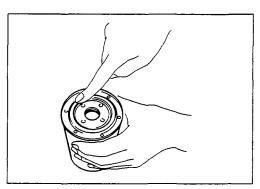
Filter Wrench: 5-8840-0253-0 (J-22700)



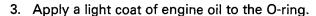


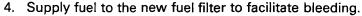
2. Clean the upper cover fitting face.

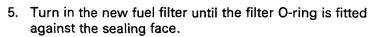
This will allow the new fuel filter to seat properly.









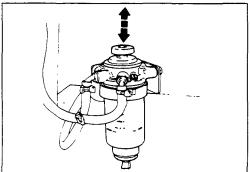


Be very careful to avoid fuel spillage.

6. Use the filter wrench to turn in the fuel filter an additional 1/3 to 2/3 of a turn.

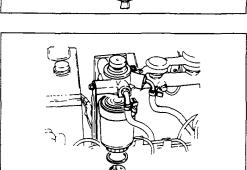
Filter Wrench: 5-8840-0253-0 (J-22700)

Loosen the bleeder screw on the injection pump overflow valve.





- 8. Operate the priming pump until fuel mixed with foam flows out of the bleeder screw.
- 9. Retighten the bleeder screw.
- 10. Operate the priming pump several times while checking for fuel leakage.



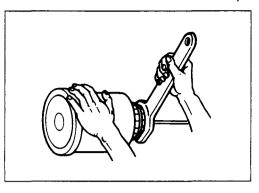


#### Water Separator Replacement Procedure

1. Remove the water separator by turning it counterclockwise with a filter wrench.

Filter Wrench: 5-8840-0253-0 (J-22700)

2. Remove the level sensor from the separator body by turning it counterclockwise with a wrench.





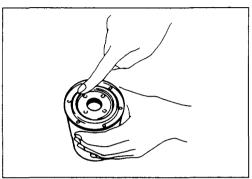
3. Install the level sensor to the water separator body with wrench.

Level Sensor Torque

kg-m(lb.ft/N-m)

1.3 (9.4/12.7)

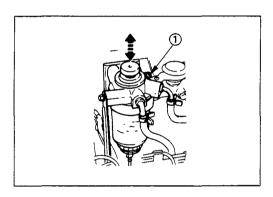
Clean the water separator cover fitting faces.
 This will allow the new fuel filter to seat properly.





- 5. Apply a light coat of engine oil to the O-ring.
- 6. Turn in the fuel filter until the sealing face comes in contact with the O-ring.
- 7. Turn in the fuel filter an additional 2/3 of a turn with a filter wrench.

Filter Wrench: 5-8840-0253-0 (J-22700)





- 8. Loosen the bleeder plug ① on the priming pump body.
- 9. Operate the priming pump until fuel begins to flow from the fuel filter.
- 10. Retighten the bleeder plug ①.
- 11. Operate the priming pump several times and check for fuel leakage.

#### Note:

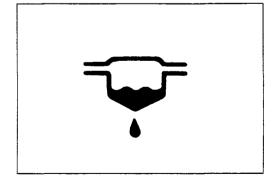
The use of an ISUZU genuine fuel filter is strongly recommended.



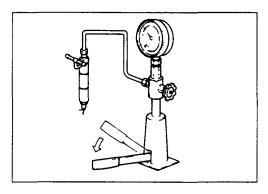
#### **Draining Procedure**

The indicator light will come on when the water level in the water separator exceeds the specified level.

Drain the water and foreign material from the water separator with the following procedure.



- 1. Place the end of the vinyl hose (beneath the drain plug) in a container.
- 2. Loosen the drain plug ①.
- 3. Operate the priming pump ② several times to drain the water.
- 4. After draining the water, tighten the drain plug ①.
- 5. Operate the priming pump several times and check for fuel leakage.
- 6. Check the water separator indicator light. It should be off.





#### **Injection Nozzle Inspection**

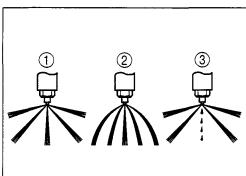
Use a nozzle tester to check the injection nozzle opening pressure and the spray condition.

If the opening pressure is above or below the specified value, the injection nozzle must be replaced or adjusted.

Injection Nozzle Opening Pressure

kg/cm<sup>2</sup>(psi/kPa)

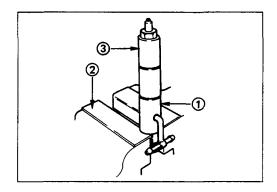
185 (2,631/18,143)



If the spray condition is bad, the injection nozzle must be replaced or repaired.

**Spray Condition** 

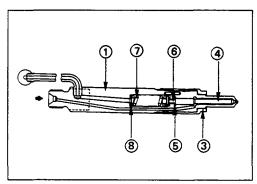
- Correct
- 2 Incorrect (Restrictions in orifice)
- ③ Incorrect (Dripping)





## Injection Nozzle Adjustment

- 1. Clamp the injection nozzle holder ① in a vise ②.
- 2. Use a wrench to remove the injection nozzle retaining nut ③.



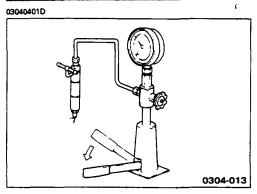


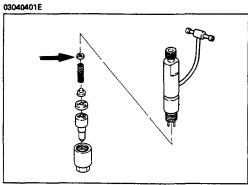
- 3. Remove the injection nozzle holder from the vise.
- 4. Remove the injection nozzle 4, the spacer 5, the spring seat 6, the spring 7 and the adjusting shim 8.
- Install the new adjusting shim, the spring, the spring seat, the spacer, the injection nozzle, and the retaining nut.
- 6. Clamp the injection nozzle holder in the vise.
- 7. Tighten the injection nozzle holder retaining nut to the specified torque.

Injection Nozzle Holder Retaining Nut Torque

kg·m(ft.lbs/N·m)

 $3.5 \pm 0.5 (25.3 \pm 3.6/34.3 \pm 4.9)$ 





- 8. Remove the injection nozzle holder from the vise.
- 9. Attach the injection nozzle holder to the injection nozzle tester.
- 10. Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.
  If the injection nozzle does not open at the specified pressure, install or remove the appropriate number of adjusting shims to adjust it.

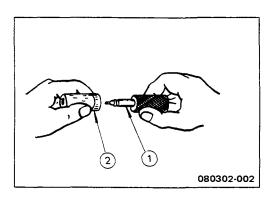
#### (Reference)

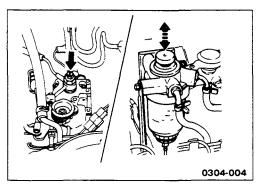
Removing or installing one shim will increase or decrease the nozzle opening pressure approximately  $3.77~kg/cm^2$  (53.6 psi/370 kPa).

Adjusting Shim Availability	mm(in)
Range	0.5 - 1.5 (0.02 - 0.06)
Increment	0.025 (0.001)
Total No. of Shims	41

#### Warning:

Test fluid from the injection nozzle tester will spray out under great pressure. It can easily puncture a person's skin. Keep your hands away from the injection nozzle holder tip at all times.







#### **Nozzle Lapping Procedure**

1. Lap the nozzle needle ① and the nozzle body ② by applying a compound of oxidized chrome and animal oil.

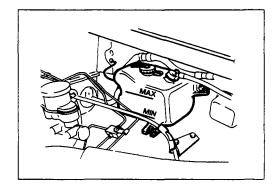
#### Note:

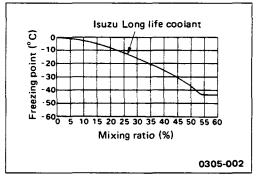
Do not apply an excessive amount of the oxidized chrome and animal oil compound to the injection needle valve seat area.

2. Carefully wash the needle valve and the nozzle body in clean diesel fuel after lapping.

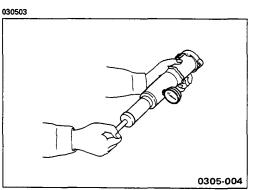
#### Air Bleeding

- 1. Loosen the bleeder screw on the injection pump overflow valve.
- 2. Operate the priming pump until fuel mixed with foam flows from the bleeder screw.
- 3. Tighten the bleeder screw.
- 4. Operate the priming pump several times and check for fuel leakage.





# 0305-003



#### **COOLING SYSTEM**

#### Coolant Level

Check the coolant level and replenish the radiator reserve tank as necessary.

If the coolant level falls below the "MIN" line, carefully check the cooling system for leakage. Then add enough coolant to bring the level up to the "MAX" line.

#### Note:

Do not overfill the reserve tank.

Remove the radiator filler cap only when absolutely necessary.

Always check the coolant level when the engine is cold.

Always refer to the chart at the left to determine the correct cooling water to antifreeze solution mixing ratio.



#### **Cooling System Inspection**

Install a radiator filler cap tester to the radiator. Apply testing pressure to the cooling system to check for leakage. The testing pressure must not exceed the specified pressure.

Testing Pressure	kg/cm² (psi/kPa)
2 (28.45/196)	



#### **Radiator Cap Inspection**

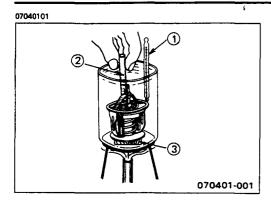
The radiator filler cap is designed to maintain coolant pressure in the cooling system at 1.05 kg/cm<sup>2</sup> (15 psi/103 kPa).

Check the radiator filler cap with a radiator filler cap tester. The radiator filler cap must be replaced if it fails to hold the specified pressure during the test procedure.

Radiator Filler Cap Pressure

Pressure Valve	kg/cm² (psi/kPa)
0.9 — 1.2 (12.8 — 17.1/88.2 — 117.6)	
Negative Valve (Reference)	kg/cm² (psi/kPa)

0.01 - 0.04 (0.14 - 0.57/0.98 - 3.92)

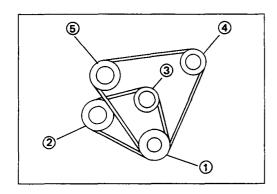


#### **Thermostat Operating Test**

- 1. Completely submerge the thermostat in water.
- Heat the water.
   Stir the water constantly to avoid direct heat being applied to the thermostat.
- 3. Check the thermostat initial opening temperature.

Thermostat Initial Opening Temperature	°C(°F)
82 (180)	
4. Check the thermostat full opening temp	erature.
Thermostat Full Opening Temperature	°C(°F)
95 (203)	
Valve Lift at Fully Open position	mm(in)
9.5 (0.37)	

- ① Thermometer
- ② Agitating rod
- ③ Wooden piece





#### **Drive Belt Adjustment**

Depress the drive belt mid-portion with a 10 kg (22 lb/98 N) force.

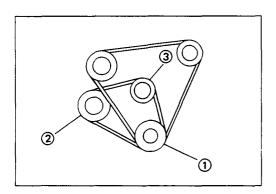
**Drive Belt Deflection** 

mm(in)

10 (0.39)

Check the drive belt for cracking and other damage.

- Crankshaft damper pulley
- 2 Alternator pulley
- 3 Cooling fan pulley
- 4 Oil pump pulley or idler pulley
- ⑤ Compressor pulley or idler pulley



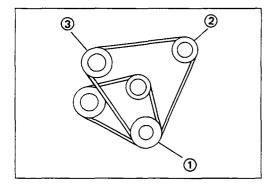


#### **Cooling Fan Pulley Drive Belt**

Fan belt tension is adjusted by moving the alternator.

Depress the drive belt mid-portion with a 10 kg (22 lb/98 N) force.

- ① Crankshaft damper pulley
- ② Alternator pulley
- ③ Cooling fan pulley





#### **Compressor Pulley Drive Belt**

Move the idler pulley as required to adjust the compressor drive belt tension.

If the vehicle is equipped with power steering, move the oil pump as required.

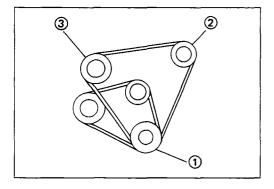
Depress the drive belt mid-portion with a 10 kg (22 lb/98 N) force.

**Belt Deflection** 

mm(in)

12 - 15 (0.47 - 0.59)

- ① Crankshaft damper pulley
- ② Oil pump pulley or idler pulley





#### **Power Steering Oil Pump Pulley Drive Belt**

Move the oil pump as required to adjust the oil pump drive belt tension.

On air conditioner equipped models, both drive belts pulley must always be replaced as a set.

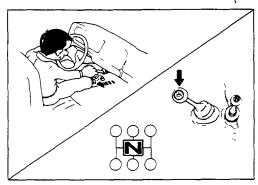
Depress the drive belt mid-portion with a 10 kg (22 lb/98 N) force.

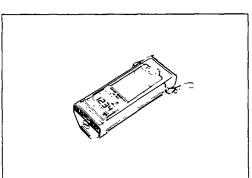
**Belt Deflection** 

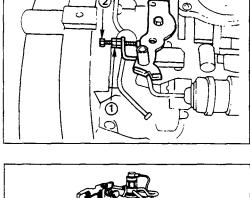
mm(in)

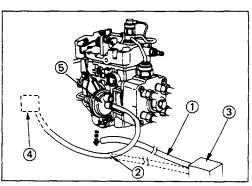
14 - 17 (0.55 - 0.67)

- Crankshaft damper pulley
- ② Oil pump pulley
- ③ Compressor pulley or idler pulley











#### **ENGINE CONTROL**

#### **Idling Speed Adjustment**

- Set the vehicle parking brake and chock the drive wheels.
- 2. Place the transmission in neutral.
- 3. Start the engine and allow it to idle until the coolant temperature reaches 70 80°C (158 176°F).
- Disconnect the engine control cable from the control lever.
- 5. Set a tachometer to the engine.
- Check the engine idling speed.
   If the engine idling speed is outside the specified range, it must be adjusted.

Engine Idling Speed

rpm

 $750 \pm 50$ 



#### **Idling Speed Adjustment**

- 1. Loosen the idling set screw lock nut ① on the injection pump idling set bolt.
- 2. Adjust the idling speed to the specified range by turning the idling set bolt ②.
- Lock the engine set bolt with the idling set screw lock nut.
- 4. Check that the idling control cable is tight (free of slack). If required, remove the slack from the cable.



#### **Fast Idling Speed Inspection**

- 1. Set tachometer to the engine.
- 2. Disconnect the vacuum hose (1) from the fast idle actuator (5) on the injection pump.
- 3. Disconnect the other vacuum hose (2) from the vacuum switching valve (3) and connect it to the fast idle actuator (5).

The vacuum line will now be connected directly from the vacuum pump (4) to the fast idle actuator.

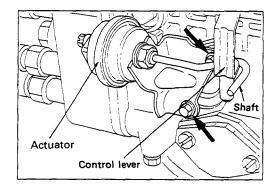
4. Check the engine fast idling speed.

If the engine idling speed is outside the specified range, it must be adjusted.

Fast Idling Speed

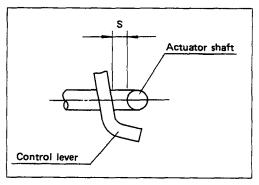
rpm

#### 6A-26 ENGINE MECHANICAL

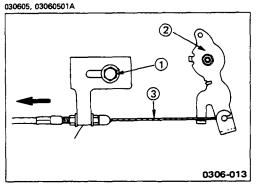


#### Fast Idling Speed Adjustment

1. Loosen the fast idle actuator bracket bolts.



- Adjust the fast idling speed by moving the actuator bracket, so that the clearance "S" can be 1 ~ 2 mm (0.04 ~ 0.08 in.).
- 3. Tighten the bracket bolts.

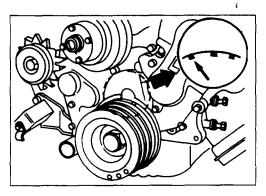




#### Accelerator Control

#### **Accelerator Control Cable Adjustment**

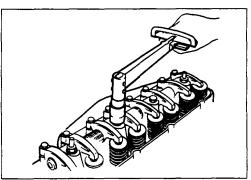
- 1. Loosen the accelerator cable clamp bolt 1.
- 2. Check that the idling control knob is in the engine idling position.
- 3. Hold the accelerator lever ② in the fully closed position and stretch the control cable ③ in the direction indicated by the arrow to remove any slack.





#### **VALVE CLEARANCE ADJUSTMENT**

1. Bring the piston in either the No. 1 cylinder or the No. 4 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft damper pulley TDC line is aligned with the timing pointer.





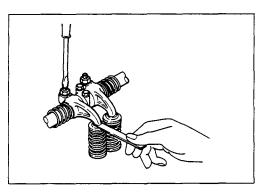
2. Check the rocker arm shaft bracket nuts for looseness.

Tighten any loose rocker arm shaft bracket nuts before adjusting the valve clearance.

Rocker Arm Shaft Bracket Nut Torque

kg·m(lb.ft/N·m)

 $5.5 \pm 0.5 \ (39.8 \pm 3.6/53.9 \pm 4.9)$ 

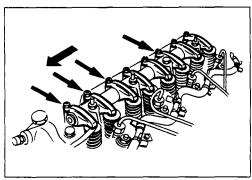




3. Check for play in the No. 1 intake and exhaust valve push rods.

If the No. 1 cylinder intake and exhaust valve push rods have play, the No. 1 piston is at TDC on the compression stroke.

If the No. 1 cylinder intake and exhaust valve push rods are depressed, the No. 4 piston is at TDC on the compression stroke.





Adjust the No. 1 or the No. 4 cylinder valve clearances while their respective cylinders are at TDC on the compression stroke.

Valve Clearance (At Cold)

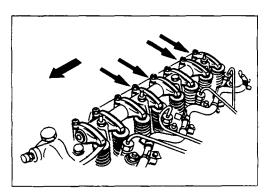
mm(in)

0.4 (0.016)

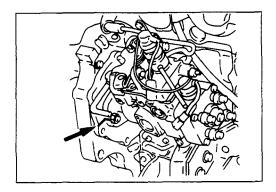
- 4. Loosen each valve clearance adjusting screw as shown in the illustration.
- 5. Insert a feeler gauge of the appropriate thickness between the rocker arm and the valve stem end.



- 6. Turn the valve clearance adjusting screw until a slight drag can be felt on the feeler gauge.
- 7. Tighten the lock nut securely.
- 8. Rotate the crankshaft 360°.
- 9. Realign the crankshaft damper pulley TDC notched line with the timing pointer.
- 10. Adjust the clearances for the remaining valves as shown in the illustration.



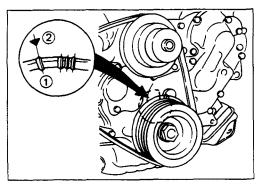






#### INJECTION TIMING ADJUSTMENT

1. Check that the notched line on the injection pump flange is aligned with the front plate or the timing gear case notched line.



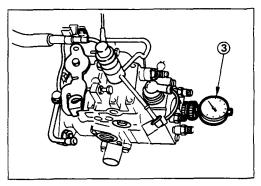


2. Bring the piston in the No. 1 cylinder to TDC ① on the compression stroke by turning the crankshaft until the crankshaft pulley TDC line is aligned with the timing mark ②.

#### Note:

Check for play in the No. 1 intake and exhaust valve push rods.

If the No. 1 cylinder intake and exhaust valve push rods have play, the No. 1 piston is at TDC on the compression stroke.

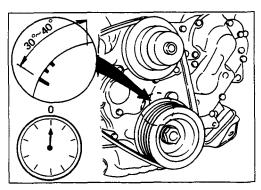




- 3. Disconnect the injection pipe from the injection pump.
- 4. Remove one bolt from the distributor head.
- 5. Insert a screwdriver into a hole in the fast idle lever and turn the lever to release the W-C.S.D. function. (If so equipped)
- 6. Install the static timing gauge ③.

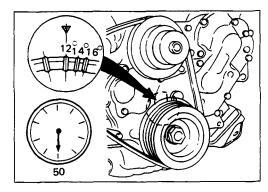
The probe of the gauge should be depressed inward approximately 2 mm (0.079 in).

Static Timing Gauge: 5-8840-0145-0 (J-28827)





- 7. Rotate the crankshaft to bring the piston in the No. 1 cylinder to a point 30 40° BTDC.
- 8. Set the timing gauge needle to zero.
- 9. Move the crankshaft pulley slightly in both directions to check that the gauge indication is stable.





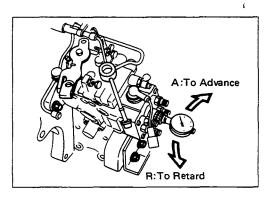
 Turn the crankshaft clockwise and read the gauge indication when the crankshaft pulley timing mark (12° (4JA1) 11° (4JB1T) on pulley) is aligned with the pointer.

Standard Reading

mm(in)

0.5 (0.02)

If the injection timing is outside the specified range, continue with the following steps.



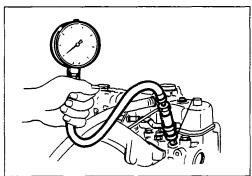


- 11. Loosen the injection pump fixing nuts and bracket bolts.
- 12. Adjust the injection pump setting angle.

	When large than standard valve	When smaller than standard valve
Gear drive	Α	R

A: Move the injection pump toward the engine.

R: Move the injection pump away from the engine.





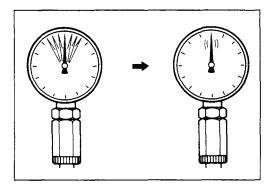
#### **COMPRESSION PRESSURE MEASUREMENT**

- 1. Start the engine and allow it to idle until the coolant temperature reaches 70 80°C (158 176°F).
- 2. Remove the following parts.
  - Glow plugs
  - Fuel cut solenoid connector
- 3. Set the adapter and compression gauge to the No. 1 cylinder glow plug hole.

Compression Gauge

(with Adapter): 5-8840-2008-0 (J-29762)

Adapter: 5-8531-7001-0



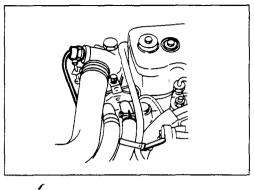


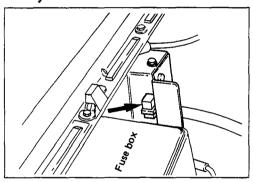
4. Turn the engine over with the starter motor and take the compression gauge reading.

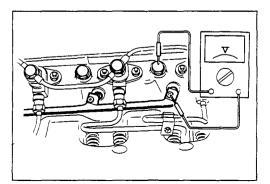
Compression Pressure	kg/cm² (psi/kPa) at 200 rpm
Standard	Limit
31 (441/3,038)	22 (313/2,156)

5. Repeat the procedure (Steps 3 and 4) for the remaining cylinders.

If the measured value is less than the specified limit, refer to "Troubleshooting" in this Manual.







#### **PRE-HEATING SYSTEM**

#### **System Inspection Procedure**

1. Disconnect the thermo-switch on the thermostat outlet pipe.

 Turn the starter switch to the "ON" position.
 If the Pre-heating System is operating properly, the glow relay will make a clicking sound about 15 seconds after the starter switch is turned on.



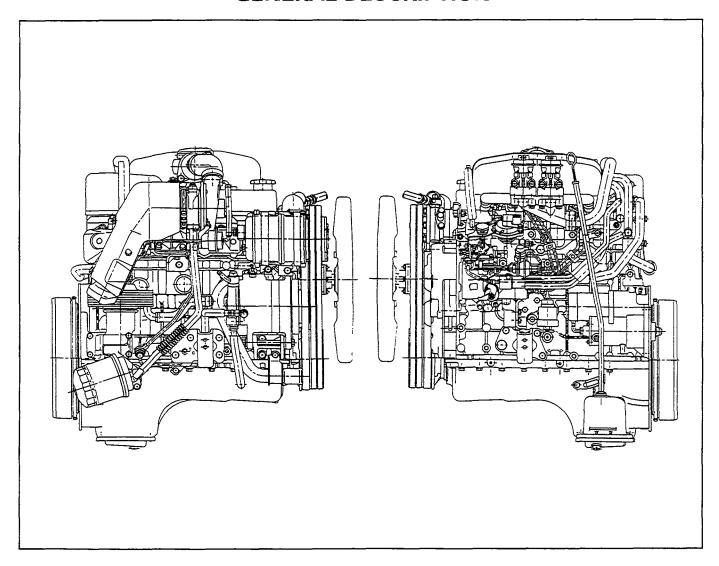
3. Measure the glow plug terminal voltage with a circuit tester immediately after turning the starter switch to the "ON" position.

Glow Plug Terminal Voltage

. . .

Approx. 11

### **GENERAL DESCRIPTION**



The 4J series automotive diesel engine has SPECIAL DESIGNED combustion chambers in the piston. This design provides superior fuel economy over a wide range of driving conditions.

Auto-thermatic pistons with cast steel struts are used to reduce thermal expansion and resulting engine noise when the engine is cold.

Chrome plated dry type cylinder liners provide the highest durability.

The laminated steel sheet cylinder head gasket is very durable and, to increase the head gasket reliability.

The crankshaft has been tufftrided to provide a longer service life. Because the crankshaft is tufftrided, it cannot be reground.

The engines are equipped with the VE-Type distributor injection pump.

The 4JB1T and 4JA1T engines are turbocharger equipped.

## **++**

### **+**+

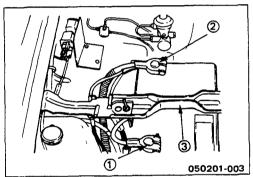
#### REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

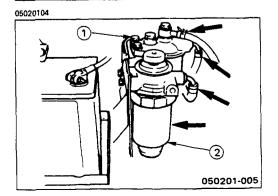


#### Important Operations - Removal

- ▲ Carefully remove the piping, hoses, wiring harness connectors, engine control cables, and control rods from the engine.
- A Remove the clutch sleeve cylinder, the back up light switch connector, and the speedometer cable from the transmission.



# 05020103



#### Battery

- 1. Disconnect the battery cable ① and the grounding cable ② from the battery terminals.
- Remove the battery clamp 3.
   Take care not to accidentally short the battery with the spanner or some other tool.
- 3. Remove the battery.
- 4. Disconnect the battery cable at the starter motor and the ground cable at the cylinder body.

#### **Engine Hood**

Apply setting marks to the engine hood 1 and the engine hood hinges 2 before removing the engine hood.

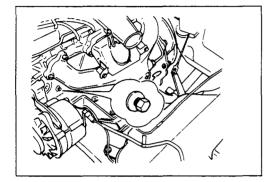
This will facilitate reinstallation of the engine hood to its original position.

#### Fuel Filter and Water Separator

- 1. Pull the fuel hose from the fuel filter 1 and the water separator 2.
- 2. Plug the fuel hose to prevent fuel leakage.
- 3. Remove the fuel filter and the water separator.

#### Air Cleaner

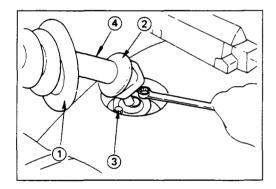
Remove the air cleaner duct from the engine.



#### Coolant

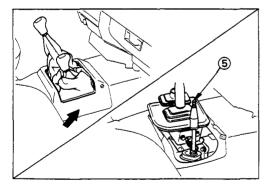
Remove the coolant drain plug (at the lower left of the engine) and the radiator drain plug.

Allow the engine coolant to drain completely.

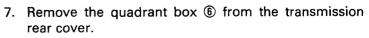


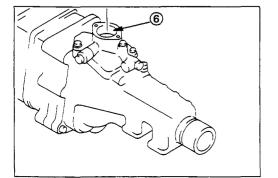
#### **Gear Shift Lever**

- 1. Place the gear shift lever in the neutral position.
- 2. Remove the front console from the floor panel.
- 3. Pull the gear shift lever grommet ① and the dust cover ② to the top of the gear shift lever.
- 4. Remove the gear shift lever cover bolt 3.
- 5. Remove the gear shift lever 4.



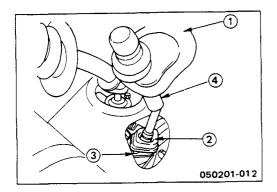
6. Remove the gear shift lever hole cover ⑤ or the center console from the floor.

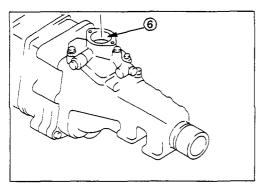


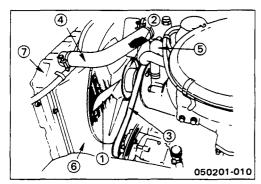


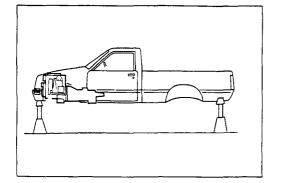
#### Note:

Cover the quadrant box hole to prevent the entry of foreign material into the transmission.









#### Transfer Change Lever (For 4 x 4)

Perform this procedure after removing the gear shift lever.

- 1. Place the transfer change lever in the "H" position.
- 2. Pull the transfer change lever grommet ① and the dust cover ② to the top of the transfer change lever.
- 3. Remove the retainer bolts (3).
- 4. Remove the transfer change lever 4 along with the retainer and the ball seat cover.
- 5. Remove the change lever hole cover 5 or the center console from the floor.
- 6. Remove the quadrant box 6 from the transfer case adapter.

#### Note:

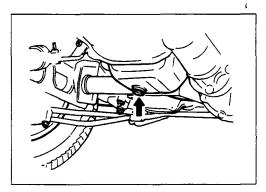
Cover the quadrant box hole and the change lever hole to prevent the entry of foreign material into the transmission.

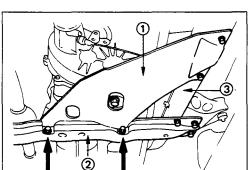
#### Radiator

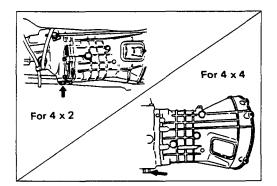
- 1. Remove the cooling fan ①, the pulley ②, and the belt ③.
- Disconnect the radiator upper hose (4) and the radiator lower hose (5) from the engine.
- 3. Remove the radiator shroud (6).
- 4. Remove the radiator grille from the deflector panel.
- Remove the radiator 7.
   Take care not to damage the radiator core.
- 6. Remove the radiator undercover from the chassis frame.

#### Supporting the Vehicle

- 1. Jack up the vehicle.
- Place chassis stands at the front and the rear of the vehicle.
- 3. Remove the wheels from the vehicle.







#### **Engine Oil Draining**

Remove the oil pan drain plug to drain the engine oil.

Do this while the engine is hot.

Do not forget to reinstall the drain plug after draining the engine oil.

#### Transfer Case Protector (4 x 4 model)

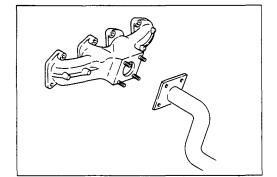
Remove the transfer case protector ① from the transmission mounting member ② and the side member ③.

#### **Transmission Oil Draining**

- 1. Remove the transmission oil drain plug.
- 2. Replace the drain plug after draining the oil.

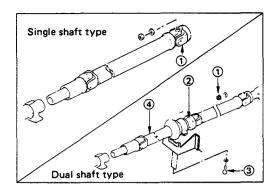
#### **Control Cables or Rods**

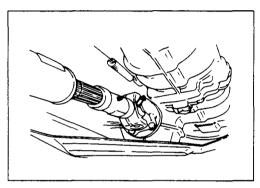
- 1. Disconnect the clutch control cable or the hydraulic cylinder from the transmission.
- 2. Disconnect the parking brake control cable from the rear wheel brake back plate.
- 3. Disconnect the speedometer drive cable from the transmission.

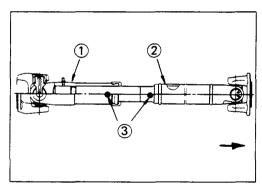


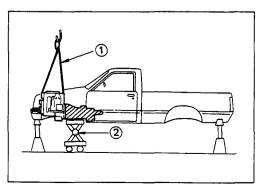
#### **Exhaust Pipe**

 Disconnect the exhaust pipe from the exhaust manifold.









#### **Rear Propeller Shaft**

- 1. Remove the propeller shaft flange yoke at the drive pinion (1).
- 2. Remove the 2nd propeller shaft flange yoke bolts 2 at the center bearing.
- 3. Remove the center bearing retainer bolts 3.
- 4. Remove the 1st propeller shaft 4 together with the center bearing from the transmission mainshaft spline.

#### Front Propeller Shaft (For 4 x 4)

Remove the splined yoke flange bolt at the transfer output shaft.

Do not allow the splined yoke to fall away from the front propeller shaft.

If the splined yoke should fall away from the front propeller shaft, align the setting marks (3) on the splined yoke (1) and the propeller shaft (2) to reassemble the two parts.

The setting marks are punched circles approximately 3 mm (0.12 in) in diameter.

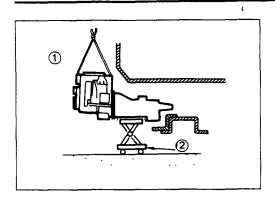
#### **Transmission**

- 1. Check that the lifting wires 1 are securely attached.
- 2. Operate the hoist to slightly raise the engine.

#### Warning:

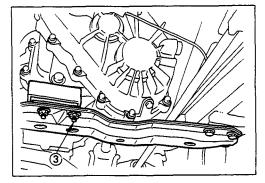
Take care not to lift the chassis from the chassis stands.

If you do accidentally raise the chassis from the chassis stands, make absolutely certain that the chassis stands are correctly positioned before lowering the chassis.

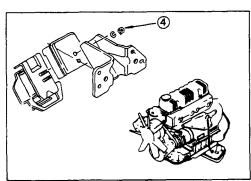




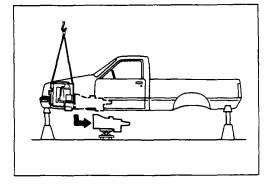
4. Operate the jack to slightly raise the transmission.



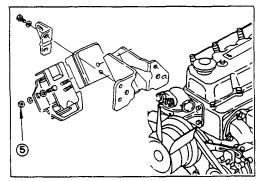
5. Remove the transmission member lower mounting bolts 3 fixing the transmission member to the chassis frame rail.



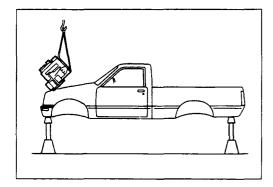
- 6. Loosen the engine mounting nuts 4 at the rubber mountings.
- 7. Use the jack to slightly lower the transmission.
- 8. Remove the remaining transmission coupling bolts.
- Separate the transmission from the engine.
   Take care not to damage the transmission, the engine, and their related parts.



10. Use the jack to lower the transmission together with the mounting member to the floor.



11. Remove the engine mounting bolts 5 from the chassis frame.

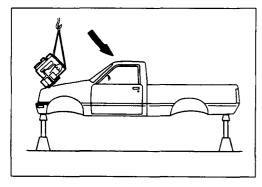


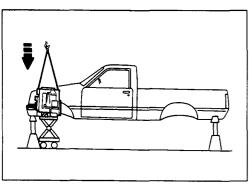
12. Use the hoist to lift the engine from the engine compartment.



#### Important Operations – Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

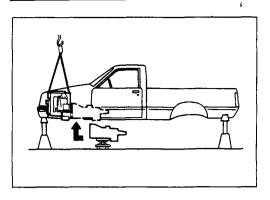




#### **Engine**

- 1. Attach a lifting wire to the engine lifting hanger.
- 2. Operate the hoist to position the engine above the engine compartment.
  - Hold the front of the engine slightly higher than the rear.
- 3. Slowly lower the engine into the engine compartment.
  - Be careful not to damage the brake pipes, the fuel pipes, and other exposed parts.
- 4. Support the oil pan with a jack.

5. Temporarily tighten the engine front mounting rubber nuts.



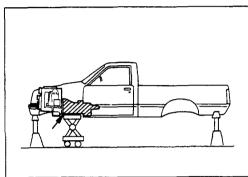








- 1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Place the transmission with the mounting rubbers on a transmission lack.
- 3. Carefully move the transmission jack and transmission into position behind the cab.

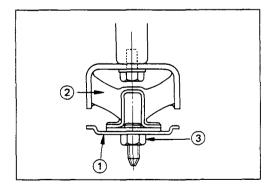




- 4. Slowly raise the transmission jack until the front of the transmission is aligned with the engine flywheel. The slope of the engine and the transmission must be the same.
- 5. Align the top gear shaft spline with the clutch driven plate internal spline.
- 6. Install the transmission to the engine. Tighten the transmission coupling nuts and bolts to the specified torque.

Transmission Coupling Nut and Bolt kg·m(lb.ft/N·m) Torque

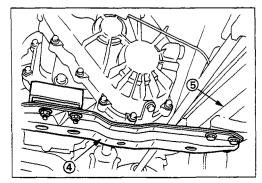
 $3.8 \pm 0.8 (27.5 \pm 5.8/37.2 \pm 7.8)$ 





- 7. Install the mounting member 1 to the mounting rubber (2).
- 8. Tighten the mounting member nuts (3) to the specified torque.

Mounting Rubber Nut Torque  $kg \cdot m(lb.ft/N \cdot m)$  $4.2 \pm 0.5 (30.4 \pm 3.6/41.2 \pm 4.9)$ 

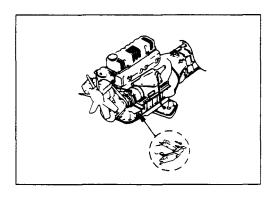




- 9. Install the mounting member 4 to the sidemembers
- 10. Tighten the mounting member bolts to the specified torque.

kg·m(lb.ft/N·m) Mounting Member Bolt Torque

 $7.8 \pm 1.6 (56.1 \pm 11.2/76.0 \pm 15.2)$ 



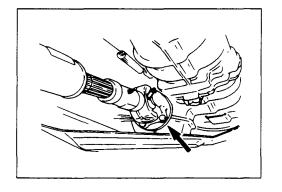


11. Tighten the engine mounting rubber nuts to the specified torque.

<b>Engine Mounting Rubber Nut Torque</b>	kg·m(lb.ft/N·m)
4.2 ± 0.5 (30.4 ± 3.6/41.2 ± 4.9)	

#### **Exhaust Pipe**

Connect the exhaust pipe to the exhaust manifold.  $kg \cdot m(lb.ft/N \cdot m)$ **Torque**  $6.8 \pm 0.5 (49 \pm 3.6/67 \pm 5)$ 





#### Front Propeller Shaft (For $4 \times 4$ )

- 1. Connect the propeller shaft flange yoke to the matching flange.
- 2. Tighten the propeller shaft flange voke bolt to the specified torque.

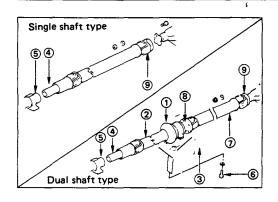
Propeller Shaft Flange Yoke Bolt

kg·m(lb.ft/N·m) Torque  $3.6 \pm 0.3$  (26.1  $\pm$  2.2/35.3  $\pm$  3.0)

#### Note:

If the splined yoke and the front propeller shaft have accidentally separated, align their setting marks and recouple them.

Refer to "FRONT PROPELLER SHAFT REMOVAL."





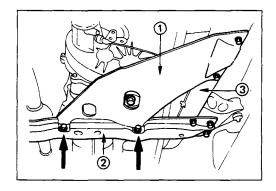
#### Rear Propeller Shaft

- 1. Place the center bearing and retainer ① together with the 1st propeller shaft ② on the No. 4 crossmember ③.
- 2. Insert the splined yoke ④ into the transmission main shaft spline ⑤.
- 3. Tighten the center bearing retainer bolts **(6)** to the specified torque.

Center Bearing	ng Retainer Bolt Torque	kg·m(lb.ft/N·m)
	$6.2 \pm 0.2$ (44.8 $\pm$ 1.5/60.8	± 2.0)

4. Connect the 2nd propeller shaft ⑦ center coupling side ⑧ and drive pinion side ⑨.

Propeller Shaft Flange Yoke Bolt	
Torque	kg·m(lb.ft/N·m)
$3.6 \pm 0.3 \ (26.0 \pm 2.2/35.3)$	3 ± 2.9)

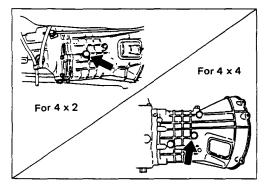




#### Transfer Case Protector (For $4 \times 4$ )

- 1. Install the transfer case protector ① to the mounting member ② and the sidemembers ③.
- 2. Tighten the transfer case protector bolts to the specified torque.

Transfer Case Protector Bolt Torque	kg·m(lb.ft/N·m)
3.7 ± 1.0 (26.8 ± 7.2/36.3 ±	9.8)



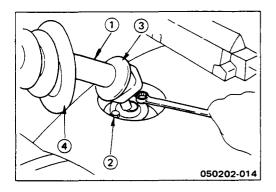


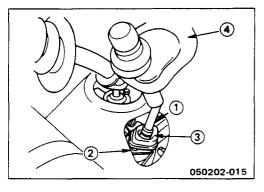
#### **Gear Shift Lever**

1. Replenish the transmission case and the transfer case with the specified engine oil.

Transmission	n and Transfer Case Oil	lit(US/UK gal)
	4 × 2	4 × 4
MSG	1.55 (0.41/0.34)	4.40 (1.16/0.97)
MUA	2.95 (0.65/0.54)	2.95 (T/M) 1.45 (Transter)

2. Install the quadrant box to the transmission rear cover.





- 3. Install the gear shift lever ① to the transmission
- 4. Tighten the gear shift lever cover ② bolts to the specified torque.

Shift Lever Cover Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $2.0 \pm 0.2 (14.5 \pm 1.5/19.6 \pm 2.0)$ 

5. Install the dust cover 3 and the grommet 4.



#### Transfer Change Lever (For $4 \times 4$ )

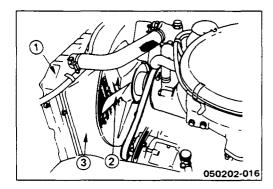
- 1. Insert the transfer change lever ① into the transfer side case.
- 2. Install the ball seat cover along with the change lever retainer ②.
- 3. Tighten the change lever retainer bolts to the specified torque.

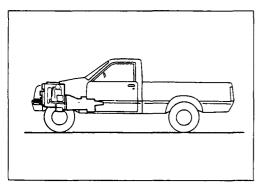
Change Lever Retainer Bolt Torque

kg·m(lb.ft/N·m)

 $2.0 \pm 0.2 (14.5 \pm 1.5/19.6 \pm 2.0)$ 

4. Install the dust cover 3 and the grommet 4.





#### Radiator

- Install the radiator ①.
   Be careful not to damage the radiator core.
- 2. Install the cooling fan 2 and the fan shroud 3.
- 3. Connect the radiator upper and lower hoses.
- 4. Install the radiator undercover to the chassis frame.
- 5. Install the radiator grill to the deflector panel.

#### Lowering the Vehicle

- 1. Install the wheels to the vehicle.
- 2. Place a jack beneath the vehicle.
- 3. Raise the jack to remove the chassis stands.
- 4. Lower the vehicle to the ground.

#### **Coolant Replenishment**

Replenish the cooling system with coolant.

Coolant Capacity	lit(US/UK gal)	
4JA1	7.0 (1.8/1.5)	
4JB1 with turbo engine	9.5 (2.5/2.1)	

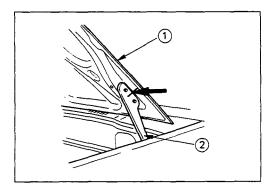


#### **Engine Oil Replenishment**

1. Fill the engine through the filler port with new engine oil of the specified grade.

Engine Oil Capacity and Grade		lit(US/UK gal)
Capacity	5.0 (1.32/1.1) only oil pan	
Grade	For 4JA1	CC or CD
	For A IR1T	CD

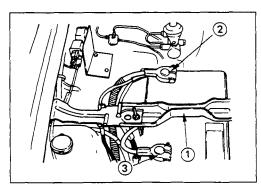
- 2. Start the engine and allow it to idle for several minutes.
- 3. Stop the engine and wait five minutes for the oil to settle.
- 4. Recheck the oil level and replenish if necessary.





#### **Engine Hood**

Align the setting marks (applied at removal) on the engine hood ① and the engine hood hinges ② to install the engine hood.





#### **Battery**

- 1. Check the battery fluid level and the specific gravity.
- 2. Secure the battery with the battery clamp. Do not overtighten the battery clamp.
- Connect the battery cable ② and the ground cable③ to the battery.
- 4. Connect the battery cable to the starter motor and the ground cable to the cylinder body.
- 5. Apply grease to the battery terminals.



#### **Engine Warm-Up**

After completing the required maintenance procedures, start the engine and allow it to idle until it is warm.

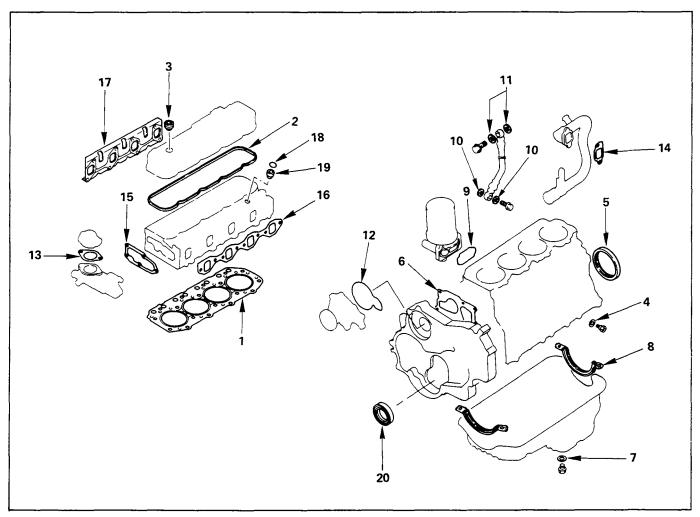
#### Check the following:

- Engine idling speed
   Refer to "SERVICING" for the idle speed adjustment
   procedure.
- 2. Engine noise level
- 3. Engine lubricating system and cooling system Carefully check for oil and coolant leakage.
- 4. Engine control cable operation
- 5. Clutch engagement
- 6. Indicator warning light operation

### **ENGINE REPAIR KIT**

All of the numbered parts listed below are included in the Engine Repair Kit.

The gaskets marked with an asterisk (\*) are also included in the Top Overhaul Kit.



- \* 1. Cylinder head gasket
- \* 2. Head cover gasket
- \* 3. Head cover cap nut gasket
  - 4. Drain cock gasket
  - 5. Crankshaft rear oil seal
  - 6. Gear case gasket
  - 7. Oil pan drain plug gasket
  - 8. Oil pan gasket
  - 9. Oil filter gasket
  - 10. Joint bolt gasket

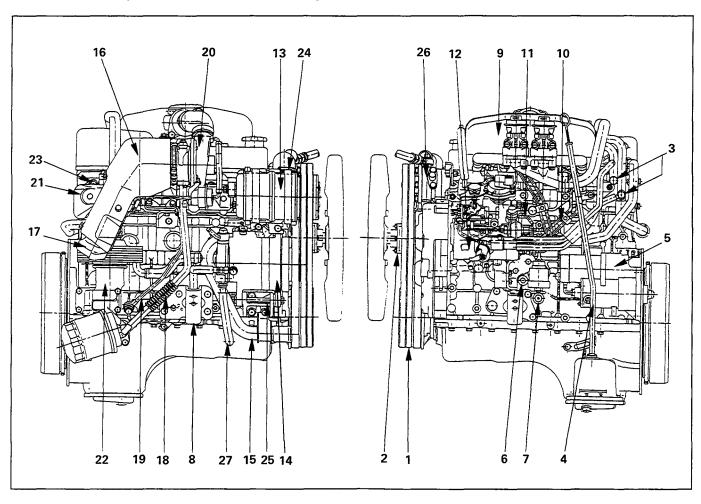
- 11. Vacuum pump gasket
- 12. Water pump O-ring
- \* 13. Water outlet pipe gasket
- \* 14. Intake pipe gasket
  - 15. Thermostat housing gasket
- \* 16. Intake manifold gasket
- \* 17. Exhaust manifold gasket
- \* 18. Nozzle holder O-ring
- \* 19. Nozzle holder gasket
  - 20. Crankshaft front oil seal

#### **ENGINE OVERHAUL**

## **←→** REMOVAL

### **EXTERNAL PARTS**

These removal steps are based on the 4JB1T engine



#### **Removal Steps**

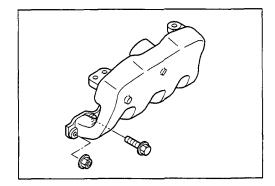
- 1. Cooling fan drive belt
- 2. Cooling fan pulley
- 3. Heater pipe (rear side)
- 4. Oil level gauge and guide tube
- 5. Starter motor
- 6. Water drain cock
- 7. Oil pressure warning switch and nipple
- 8. Engine mounting bracket
- ▲ 9. Intake manifold
- ▲ 10. Fuel injection pipe with clip
  - 11. Fuel leak off pipe
  - 12. Injection pump
  - 13. Compressor
  - 14. Alternator and adjusting plate
  - 15. Water inlet pipe

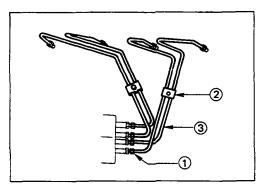
- 16. Turbocharger heat protector
- 17. Exhaust adapter
- 18. Turbocharger oil return pipe
- 19. Turbocharger oil feed pipe
- ▲ 20. Turbocharger
  - 21. Exhaust manifold heat protector
  - 22. Oil cooler with Oil filter
  - 23. Exhaust manifold
  - 24. Compressor bracket
  - 25. Alternator bracket
  - 26. Power steering oil pump
  - 27. Vacuum pipe

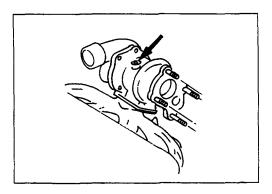
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#### **Important Operations**







#### 9. Intake Manifold

- 1) Disconnect the PCV hose from the cylinder head cover.
- 2) Disconnect the intake duct and intake rubber hose from the turbocharger.
- 3) Remove the upper intake manifold the lower intake manifold with intake duct, and the PCV hose.

#### 10. Fuel Injection Pipe with Clip

- 1) Loosen the injection pipe sleeve nuts at the delivery valve side ①.
  - Do not apply excessive force to the injection pipes.
- 2) Loosen the injection pipe clips 2.
- 3) Remove the injection pipes 3.

#### Note:

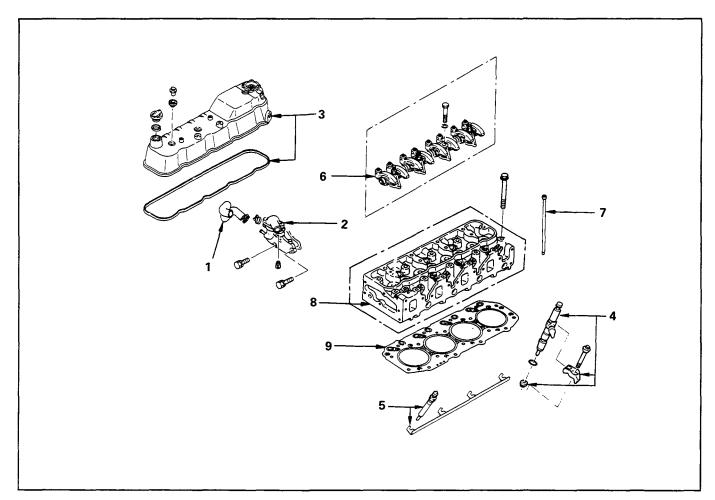
Plug the delivery holder ports with the shipping caps to prevent the entry of foreign material.

#### 20. Turbocharger

Plug the turbocharger body oil ports after removing the turbocharger assembly to prevent the entry of foreign material.

## INTERNAL PARTS

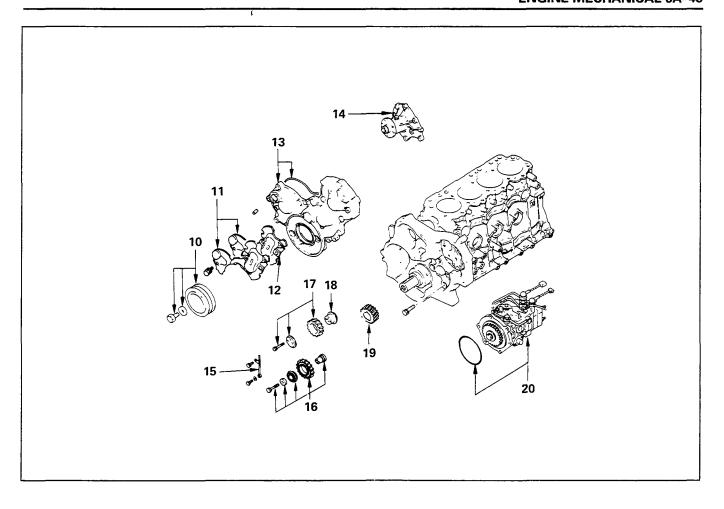
#### **MAJOR COMPONENTS**



#### **Disassembly Steps-1**

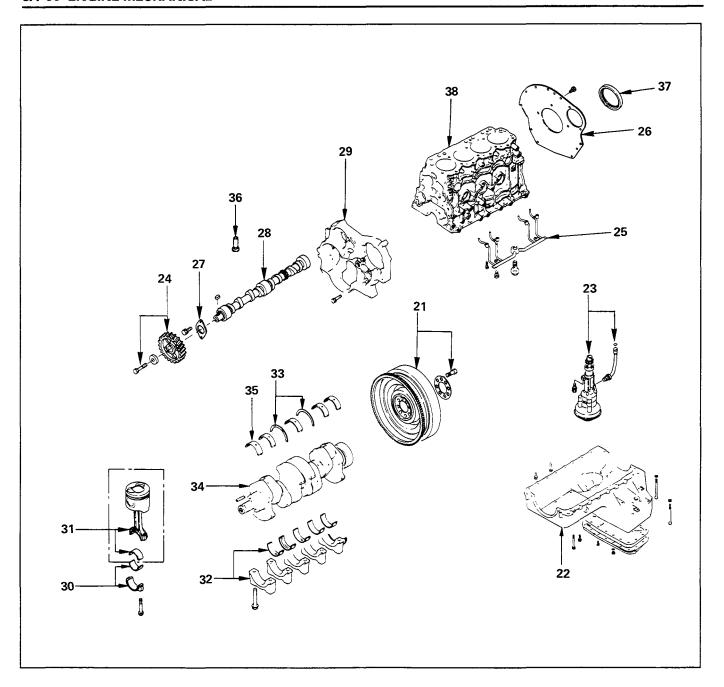
- 1. Water bypass pipe
- 2. Thermostat housing with thermo switch
- 3. Cylinder head cover
- ▲ 4. Injection nozzle holder
  - 5. Glow plug and glow plug connector

- ▲ 6. Rocker arm shaft and rocker arm
  - 7. Push rod
- ▲ 8. Cylinder head
  - 9. Cylinder head gasket



#### **Disassembly Steps-2**

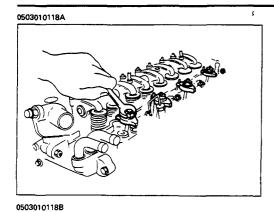
- ▲ 10. Crankshaft damper pulley
  - 11. Gear case upper cover and lower cover
  - 12. Space rubber
  - 13. Timing gear case cover
  - 14. Water pump
  - 15. Timing gear oil pipe
  - 16. Idler gear "B" and shaft
- ▲ 17. Idler gear "A"
  - 18. Idler gear shaft
  - 19. Crankshaft timing gear
- ▲ 20. Injection pump



#### **Disassembly Steps-3**

- 21. Flywheel
- 22. Oil pan
- ▲ 23. Oil pump with oil pipe
- ▲ 24. Camshaft timing gear
- ▲ 25. Piston cooling oil pipe
- ▲ 26. Cylinder body rear plate
  - 27. Camshaft thrust plate
- ▲ 28. Camshaft
  - 29. Timing gear case
- ▲ 30. Connecting rod bearing cap with lower bearing

- ▲ 31. Piston and connecting rod with upper bearing.
- ▲ 32. Crankshaft bearing cap with lower bearing
  - 33. Crankshaft thrust bearing
  - 34. Crankshaft
- ▲ 35. Crankshaft upper bearing
- ▲ 36. Tappet
- ▲ 37. Crankshaft rear oil seal
  - 38. Cylinder body

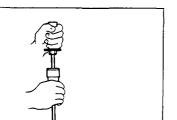




#### **Important Operations**

#### 4. Injection Nozzle Holder

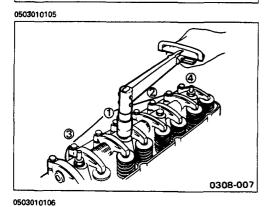
1. Remove the nozzle holder bracket nuts.





Use the nozzle holder remover and the sliding hammer to remove the nozzle holder together with the holder bracket.

Nozzle Holder Remover: 5-8840-2034-0 Sliding Hammer: 5-8840-0019-0



#### 6. Rocker Arm Shaft and Rocker Arm

Loosen the rocker arm shaft bracket bolts in numerical order a little at a time.

#### Note:

Failure to loosen the rocker arm shaft bracket bolts in numerical order a little at a time will adversely affect the rocker arm shaft.

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#### 8. Cylinder Head

Loosen the cylinder head bolts in numerical order a little at a time.

#### Note:

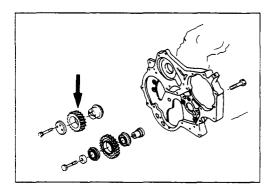
Failure to loosen the cylinder head bolts in numerical order a little at a time will adversely affect the cylinder head lower surface.

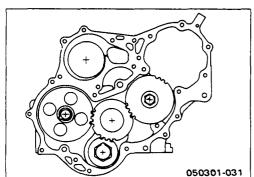
#### 10. Crankshaft Damper Pulley

Use the remover to remove the damper pulley

#### NOTE:

Hold the flywheel ring gear stationary to prevent the crankshaft from turning when removing the crankshaft pulley.





#### 17. Idler Gear "A"

- Measure the camshaft timing gear backlash and the crankshaft timing gear backlash before removing the idler gear.
- 2. Measure the idler gear end play before removing the idler gear.

#### Note:

Refer to the following items for details on the backlash and end play measurement procedures.



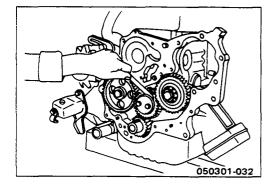
#### Timing Gear Backlash Measurement

- Set a dial indicator to the timing gear to measured.
   Hold both the gear to be checked and the adjusting gear stationary.
- 2) Move the gear to be checked as far as possible to both the right and the left.

Take the dial indicator reading.

If the measured value exceeds the specified limit, the timing gear must be replaced.

mm(in)	
Limit	
0.30 (0.012)	



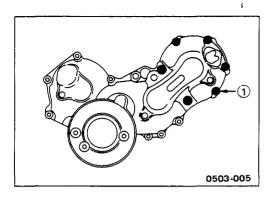


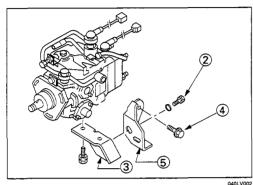
#### Idler Gear "A" End Play Measurement

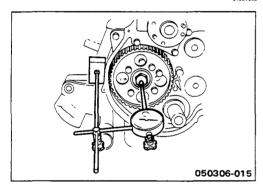
Insert a feeler gauge between the idler gear and the thrust collar to measure the gap and determine the idler gear end play.

If the measured value exceeds the specified limit, the thrust collar must be replaced.

Idler Gear End Play	mm(in)	
Standard	Limit	
0.07 (0.0028)	0.2 (0.0079)	







#### 20. Injection Pump

1. Remove the six injection pump bracket bolts ① from the timing gear case.

- 2. Remove the injection pump rear bracket bolts ② from the injection pump bracket ③.
- 3. Remove the injection pump rear bracket bolts ④ and the bracket ⑤ from the cylinder body.
- 4. Pull the injection pump along with the injection pump timing gear free toward the rear of the engine.

#### Note:

Plug the injection pump delivery holder ports with the shipping caps (or the equivalent) to prevent the entry of foreign material.

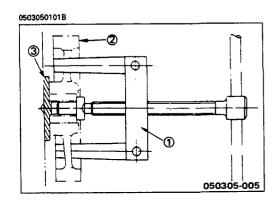
#### 19. Camshaft Timing Gear

1. Use a dial indicator to measure the camshaft end play.

This must be done before removing the camshaft gear.

If the camshaft end play exceeds the specified limit, the thrust plate must be replaced.

Camshaft End Play	mm(in)	
Standard	Limit	
0.050 — 0.114	0.20	
(0.002 - 0.0044)	(800.0)	





2. Remove the camshaft timing gear bolt from the camshaft.

#### Note:

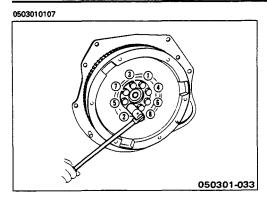
Hold the camshaft stationary to prevent the camshaft from turning.

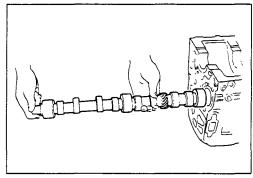
3. Use the universal puller ① to pull out the camshaft timing gear ②.

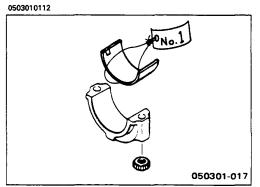
Universal Puller: 5-8521-0002-0

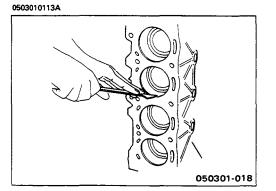
4. Remove the thrust plate 3.

#### **6A-54 ENGINE MECHANICAL**









#### 21. Flywheel

Block the crankshaft with a piece of hard wood to prevent the flywheel from turning.

Loosen the flywheel bolts in numerical order a little at a time.

#### 25. Piston Cooling Oil Pipe

The oiling jet uses thin steel tubing which is easily bent. Accidental contact between the oiling jet and the cylinder body, piston, or a tool will damage the oiling jet.

Never attempt to repair a damaged oiling jet. Replace it with a new one.

#### 28. Camshaft

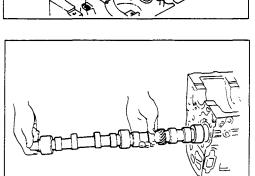
Jiggle the camshaft with your hand as you pull it free from the front of the engine.

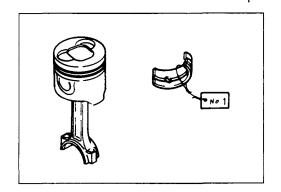
#### 30. Connecting Rod Bearing Cap with Lower Bearing

If the connecting rod lower bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

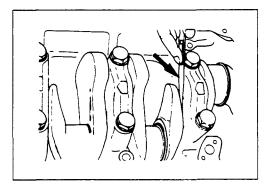
#### 31. Piston and Connecting Rod with Upper Bearing

- 1) Remove carbon deposits from the upper portion of the cylinder wall with a scraper before removing the piston and connecting rod.
- 2) Move the piston to the top of the cylinder and tap it with a hammer grip or a similar object from the connecting rod lower side to drive it out.





If the connecting rod upper bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.





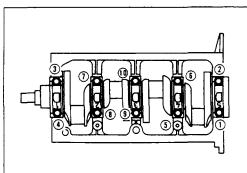
#### 32. Crankshaft Bearing Cap with Lower Bearing

1) Measure the crankshaft end play at the center journal of the crankshaft.

Do this before removing the crankshaft bearing caps.

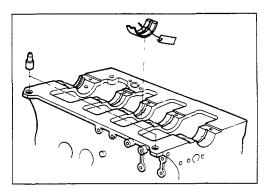
If the measured value exceeds the specified limit, the crankshaft thrust bearing must be replaced.

mm(in)	
Limit	
0.30 (0.012)	



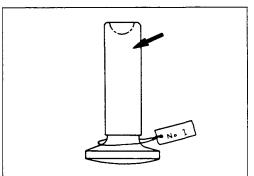
2) Loosen the crankshaft bearing cap bolts in numerical order a little at a time.

If the crankshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



#### 35. Crankshaft Upper Bearing

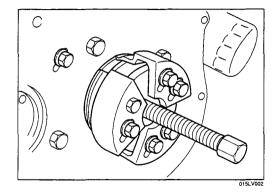
If the crankshaft upper bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



#### 36. Tappet

If the tappets are to be reinstalled, mark their fitting positions by tagging each tappet with the cylinder number from which it was removed.

#### **6A-56 ENGINE MECHANICAL**



#### 37. Crankshaft Rear Oil Seal



Be careful not to scratch the crankshaft rear oil seal fitting surfaces during the removal procedure.

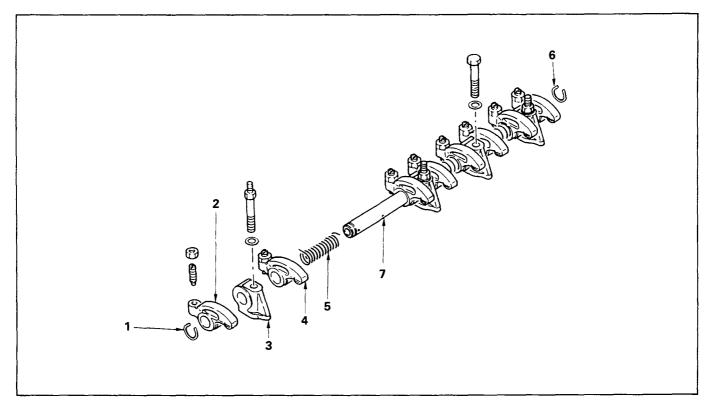
With the oil seal pushed in deep, install the special tool as shown in the illustration and remove the oil seal.

Oil Seal Remover: 5-8840-2360-0

# MINOR COMPONENTS



# **ROCKER ARM SHAFT AND ROCKER ARM**



# **Disassembly Steps**

- ▲ 1. Rocker arm shaft snap ring
- ▲ 2. Rocker arm
- ▲ 3. Rocker arm shaft bracket
  - 4. Rocker arm

- 5. Rocker arm shaft spring
- 6. Rocker arm shaft snap ring
- 7. Rocker arm shaft

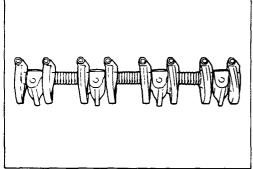


# **Important Operations**



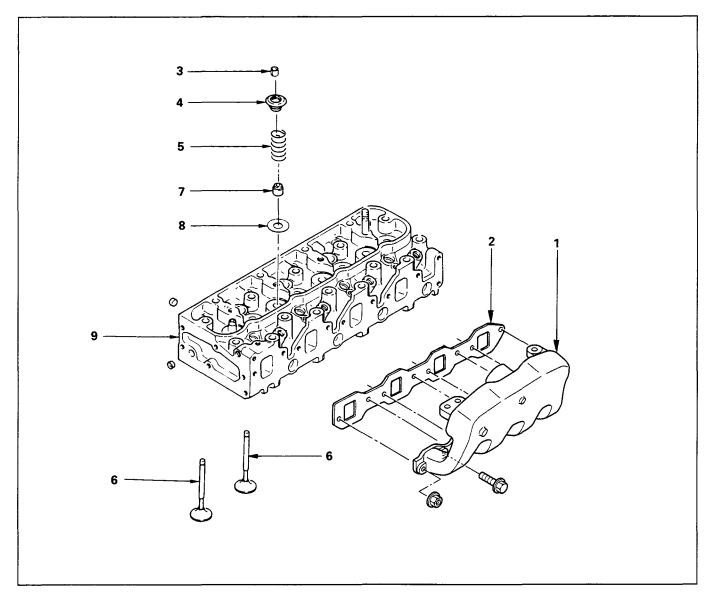
- 1. Rocker Arm Shaft Snap Ring
- 2. Rocker Arm
- 3. Rocker Arm Shaft Bracket
  - 1) Use a pair of pliers to remove the snap rings.
  - 2) Remove the rocker arms.
  - 3) Remove the rocker arm shaft brackets.

If the rocker arms and rocker arm shaft brackets are to be reinstalled, mark their installation positions by tagging each rocker arm and rocker arm shaft bracket with the cylinder number from which it was removed.





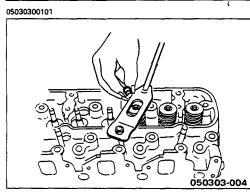
# **CYLINDER HEAD**



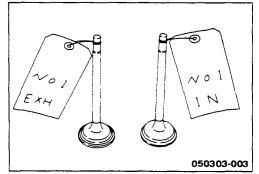
## **Disassembly Steps**

- 1. Intake manifold
- 2. Intake manifold gasket
- ▲ 3. Split collar
  - 4. Valve spring upper seat
  - 5. Valve spring

- ▲ 6. Intake and exhaust valve
  - 7. Valve stem oil seal
  - 8. Valve spring lower seat
  - 9. Cylinder head









# Important Operations



#### 3. Split Collar

- 1) Place the cylinder head on a flat wooden surface.
- Use the spring compressor to remove the split collars.

Do not allow the valve to fall from the cylinder head.

Spring Compressor: 9-8523-1423-0 (J-29760)

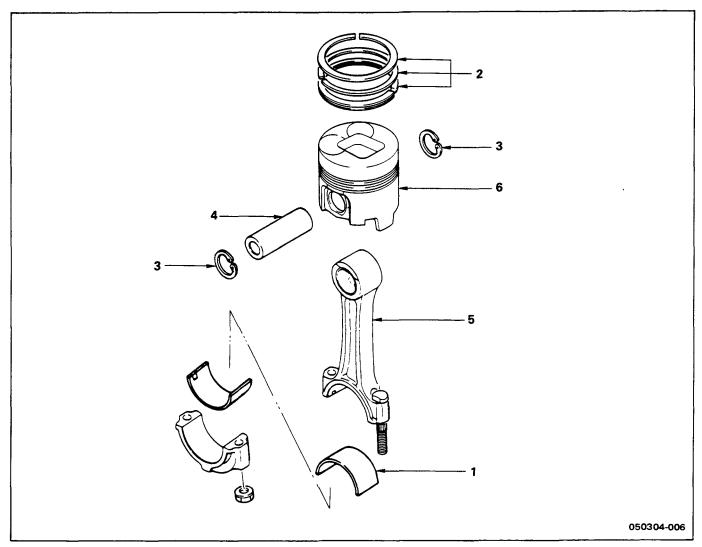
#### 4. Intake and Exhaust Valve

If the intake and exhaust valves are to be reinstalled, mark their installation positions by tagging each valve with the cylinder number from which it was removed.

If the intake and exhaust valves are to be replaced, the valve guides must also be replaced.



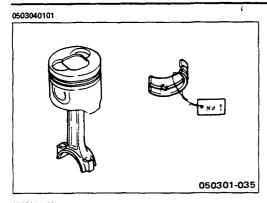
# **PISTON AND CONNECTING ROD**



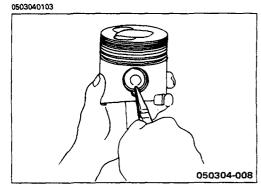
# **Disassembly Steps**

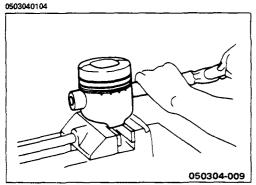
- ▲ 1. Connecting rod bearing
- ▲ 2. Piston ring
- ▲ 3. Piston pin snap ring

- ▲ 4. Piston pin
  - 5. Connecting rod
- ▲ 6. Piston



# 050304-007







## **Important Operations**

#### 1. Connecting Rod Bearing

If the connecting rod bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

#### 2. Piston Ring

- Clamp the connecting rod in a vise.
   Take care not to damage the connecting rod.
- 2) Use a piston ring replacer to remove the piston rings. Piston Ring Replacer

Do not attempt to use some other tool to remove the piston rings. Piston ring stretching will result in reduced piston ring tension.

# 3. Piston Pin Snap Ring

Use a pair of pliers to remove the piston pin snap rings.

#### 4. Piston Pin

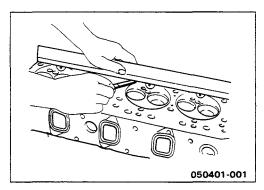
#### 6. Piston

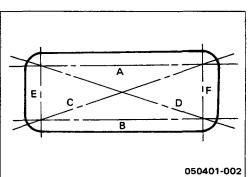
Tap the piston pin out with a hammer and a brass bar. If the pistons and piston pins are to be reinstalled, mark their installation positions by tagging each piston and piston pin with the cylinder number from which it was removed.

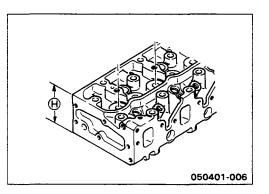


# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.









# **CYLINDER HEAD**

# **Cylinder Head Lower Face Warpage**

- 1. Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder head lower face.
- 2. Regrind the cylinder head lower face if the measured values are greater than the specified limit but less than the maximum grinding allowance.

If the measured values exceed the maximum grinding allowance, the cylinder head must be replaced.

lylinder Head Lower Face Warpage		mm(in	
Standard	Limit	Maximum Grinding Allowance	
0.05	0.20	0.30	
(0.002) or less	(0.008)	(0.012)	



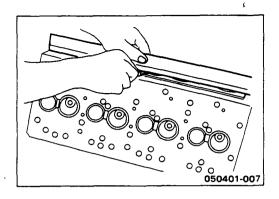
Cylinder	Head	Height	⊕ (Re	ferenc	e)

nn	

Standard	Limit
91.95 – 92.05 (3.620 – 3.624)	91.55 (3.60)

#### Note:

If the cylinder head lower face is reground, valve depression must be checked.





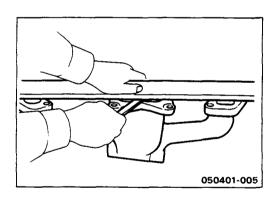
# Manifold Fitting Face Warpage

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

Regrind the manifold cylinder head fitting surfaces if the measured values are greater than the specified limit but less than the maximum grinding allowance.

If the measured values exceed the maximum grinding allowance, the cylinder head must be replaced.

Manifold Fitting Face Warpage		mm(i	
Standard Limit		Maximum Grinding Allowance	
0.05 (0.002) or less	0.20 (0.008)	0.40 (0.016)	



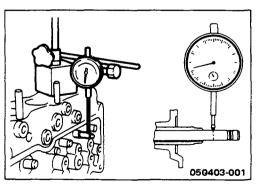


# **Exhaust Manifold Warpage**

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

If the measured values exceed the specified limit, the manifold must be replaced.

Exhaust Manifold Warpage	mm(in)	
Standard	Limit	
0.05 (0.002) or less	0.20 (0.008)	





#### **VALVE GUIDE**

# Valve Stem and Valve Guide Clearance Measuring Method-I

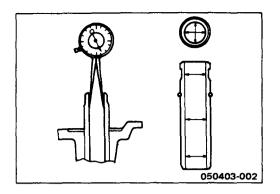
- 1. With the valve stem inserted in the valve guide, set the dial indicator needle to "0".
- 2. Move the valve head from side to side.

Read the dial indicator.

Note the highest dial indication.

If the measured values exceed the specified limit, the valve and the valve guide must be replaced as a set.

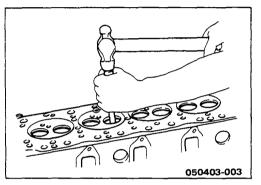
Valve Stem Clearance		mm(in)	
	Standard	Limit	
Intake Valve	0.039 - 0.069 (0.0015 - 0.0027)	0.200 (0.008)	
Exhaust Valve	0.064 - 0.093 (0.0025 - 0.0037)	0.250 (0.0098)	





#### Measuring Method-II

- 1. Measure the valve stem outside diameter. Refer to the Item "Valve Stem Outside Diameter".
- 2. Use a caliper calibrator or a telescoping gauge to measure the valve guide inside diameter.





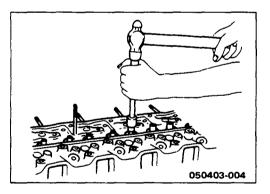
## Valve Guide Replacement

#### Valve Guide Removal



Use a hammer and the valve guide replacer to drive out the valve guide from the cylinder head lower face.

Valve Guide Replacer: 9-8523-1212-0

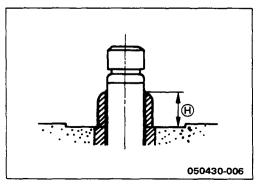




#### Valve Guide Installation

- 1. Apply engine oil to the valve guide outer circumference.
- 2. Attach the valve guide installer to the valve guide.
- 3. Use a hammer to drive the valve guide into position from the cylinder head upper face.

Valve Guide Replacer: 9-8523-1212-0



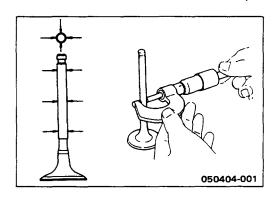


4. Measure the height of the valve guide upper end from the upper face of the cylinder head.

Valve Guide Upper End Height (H) (Reference) mm(in) 13 (0.51)

#### Note:

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.



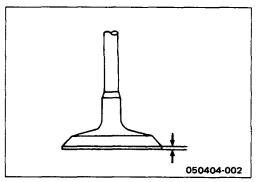


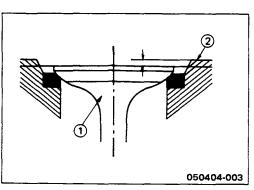
# VALVE AND VALVE SEAT INSERT Valve Stem Outside Diameter

Measure the valve stem diameter at three points.

If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

valve Stem Outside Diameter		mm(in)	
	Standard	Limit	
Intake Valve	7.946 – 7.961 (0.3128 – 0.3134)	7.880 (0.3102)	
Exhaust Valve	7.921 - 7.936 (0.3119 - 0.3124)	7.850 (0.3090)	







# Valve Thickness

Measure the valve thickness.

If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

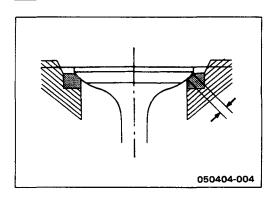
Intake and Exhaust Valve Thick	kness mm(in)
Standard	Limit
1.8 (0.07)	1.5 (0.06)

# **Valve Depression**

- 1. Install the valve (1) to the cylinder head (2).
- 2. Use a depth gauge or a straight edge with steel rule to measure the valve depression from the cylinder head lower surface.

If the measured value exceeds the specified limit, the valve seat insert must be replaced.

Valve Depression	nn	mm(in)	
	Standard	Limit	
Intake	0.73 (0.029)	1.28 (0.050)	
Exhaust	0.70 (0.028)	1.20 (0.047)	



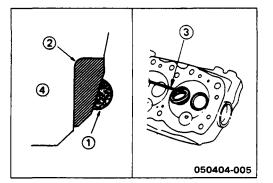


#### **Valve Contact Width**

- 1. Check the valve contact faces for roughness and unevenness. Make smooth the valve contact surfaces.
- 2. Measure the valve contact width.

If the measured value exceeds the specified limit, the valve seat insert must be replaced.

alve Contact Width		mm(i	
	Standard	Limit	
Intake	1.7 (0.067)	2.2 (0.087)	
Exhaust	2.0 (0.079)	2.5 (0.078)	



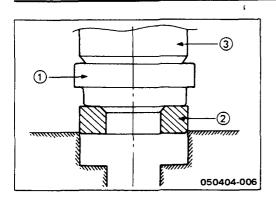




# Valve Seat Insert Replacement

# Valve Seat Insert Removal

- 1. Arc weld the entire inside circumference (1) of the valve seat insert (2).
- 2. Allow the valve seat insert to cool for a few minutes. This will invite contraction and make removal of the valve seat insert easier.
- 3. Use a screwdriver 3 to pry the valve seat insert free. Take care not to damage the cylinder head (4).
- 4. Carefully remove carbon and other foreign material from the cylinder head insert bore.





#### Valve Seat Insert Installation

1. Carefully place the attachment ① (having a smaller outside diameter than the valve seat insert) on the valve seat insert ②.

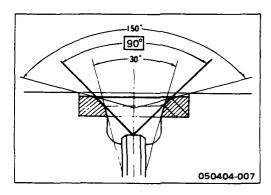
#### Note:

The smooth side of the attachment must contact the valve seat insert.

2. Use a bench press 3 to gradually apply pressure to the attachment and press the valve seat insert into place.

#### Note:

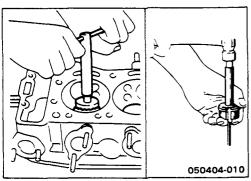
Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.





#### Valve Seat Insert Correction

- Remove the carbon from the valve seat insert surface.
- 2. Use a valve cutter (15°, 45°, and 75° blades) to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.





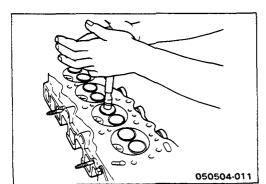
degree

45

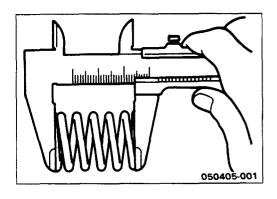
#### Note:

Use an adjustable valve cutter pilot.

Do not allow the valve cutter pilot to wobble inside the valve guide.



- 3. Apply abrasive compound to the valve seat insert surface.
- 4. Insert the valve into the valve guide.
- 5. Turn the valve while tapping it to fit the valve seat insert.
- 6. Check that the valve contact width is correct.
- 7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.





#### **VALVE SPRING**

4JB1T

## Valve Spring Free Height

Use a vernier caliper to measure the valve spring free height.

If the measured value is less than the specified limit, the valve spring must be replaced.

Inner and Outer Spring Free Height		mm(in)	
		Standard	Limit
4JA1	Inner spring	45.3 (1.78)	44.4 (1.75)
	Outer spring	49.7 (1.96)	48.2 (1.90)

Single spring

48.0 (1.89)

47.1 (1.85)

050405-002

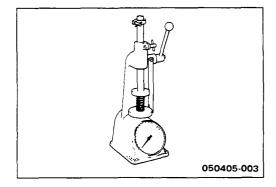


#### Valve Spring Squareness

Use a surface plate and a square to measure the valve spring squareness.

If the measured value exceeds the specified limit, the valve spring must be replaced.

Inner and Outer Spring Squareness		mm(in)
		Limit
	Inner Spring	3.0 (0.120)
4JA1	Outer Spring	3.2 (0.126)
4JB1T	Single Spring	1.7 (0.07)





# **Valve Spring Tension**

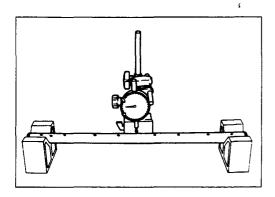
Use a spring tester to measure the valve spring tension.

If the measured value is less than the specified limit, the valve spring must be replaced.

V	а	ve	Spri	ing	Ten	sion
		_				

kg(lb/N)

		Compressed Height	Standard	Limit
4101	Inner	37.0 mm	5.9	5.0
	Spring	(1.46 in)	(13.0/57.9)	(11.0/49.0)
4JA1	Outer	39.0 mm	20.9	18.1
	Spring	(1.54 in)	(46.0/205.0)	(39.8/177.4)
4JB1T	Single	38.9 mm	30.2	26.3
	Spring	(1.53 in)	(66.4/296.0)	(57.9/257.7)





#### **ROCKER ARM SHAFT AND ROCKER ARM**

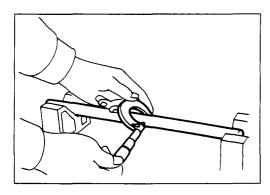
#### Rocker Arm Shaft Run-Out

- 1. Place the rocker arm shaft on a V-block.
- 2. Use a dial indicator to measure the rocker arm shaft central portion run-out.

If the run-out is very slight, correct the rocker arm shaft run-out with a bench press. The rocker arm must be at cold condition.

If the measured rocker arm shaft run-out exceeds the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Run-Out	mm(in)
Limit	
0.3 (0.012)	



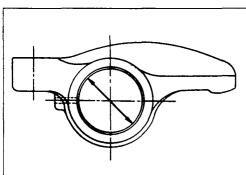


#### **Rocker Arm Shaft Outside Diameter**

Use a micrometer to measure the rocker arm fitting portion outside diameter.

If the measured value is less than the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Outside Dian	netermm(in)
Standard	Limit
18.98-19.00 (0.747-0.748)	18.90 (0.744)





#### Rocker Arm Shaft and Rocker Arm Clearance

1. Use either a vernier caliper or a dial indicator to measure the rocker arm inside diameter.

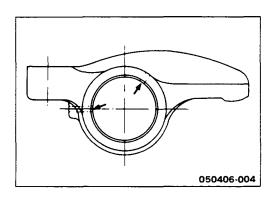
Rocker Arm Inside Diameter	mm(in)
Standard	Limit
19.036 — 19.060 (0.749 — 0.750)	19.100 (0.752)

2. Measure the rocker arm shaft outside diameter.

If the measured value exceeds the specified limit, replace either the rocker arm or the rocker arm shaft.

Rocker Arm Shaft and Rocker Arm
Clearance mm(in)

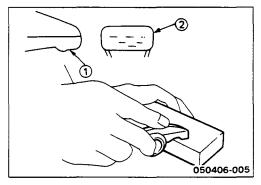
Standard	Limit
0.01 — 0.05 (0.0004 — 0.0020)	0.20 (0.008)





3. Check that the rocker arm oil port is free of obstructions.

If necessary, use compressed air to clean the rocker arm oil port.





#### **Rocker Arm Correction**

Inspect the rocker arm valve stem contact surfaces for step wear ① and scoring ②.

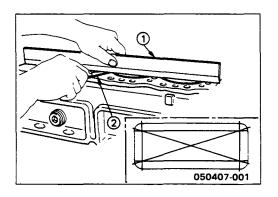
If the contact surfaces have light step wear or scoring, they may be honed with an oil stone.

If the step wear or scoring is severe, the rocker arm must be replaced.

#### **CYLINDER BODY**

#### Cylinder Body Upper Face Warpage

- 1. Remove the cylinder body dowel.
- Remove the cylinder liner.Refer to "Cylinder Liner Replacement".

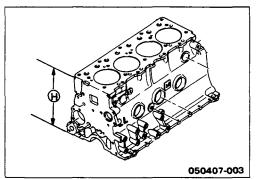




3. Use a straight edge ① and a feeler gauge ② to measure the four sides and the two diagonals of the cylinder body upper face.

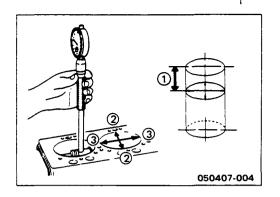
If the measured values exceeds the limit, the cylinder body must be replaced.

Standard	Limit
0.05 (0.002) or less	0.20 (0.008)



Cylinder Body	Height (Reference)	mm(in)
	Standard	
4JA1	244.945 — 245.055 (9.6430 –	- 9.6478)
4JB1T	269.945 — 270.055 (10.6277 –	- 10.6320)

- Reinstall the cylinder liner.
   Refer to "Cylinder Liner Replacement".
- 6. Reinstall the cylinder body dowel.





#### Cylinder Liner Bore Measurement

Use a cylinder indicator to measure the cylinder bore at measuring point ① in the thrust ②—② and axial ③—③ directions of the crankshaft.

Measuring Point 1 20 mm (0.79 in)

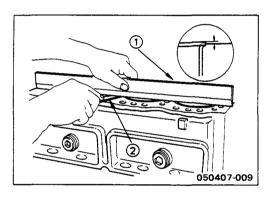
If the measured value exceeds the specified limit, the cylinder liner must be replaced.

Cylinder Liner Bore n	
Standard	Limit
93.021 (3.662)	93.100 (3.665)

#### Note:

The inside of the dry type cylinder liner is chrome plated. It cannot be rebored or honed.

If the inside of the cylinder liner is scored or scorched, the cylinder liner must be replaced.



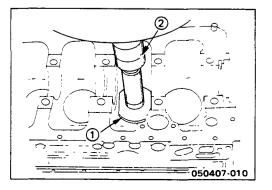


#### **Cylinder Liner Projection Inspection**

- 1. Hold a straight edge ① along the top edge of the cylinder liner to be measured.
- 2. Use a feeler gauge ② to measure each cylinder liner projection.

<u>mm(in)</u>

The difference in the cylinder liner projection height between any two adjacent cylinders must not exceed 0.03 mm (0.0012 in).





#### **Cylinder Liner Replacement**

#### **Cylinder Liner Removal**



Cylinder Liner Remo

 Insert the cylinder liner remover ① into the cylinder body (from the lower side of the cylinder body) until it makes firm contact with the cylinder liner.

Cylinder Liner Remover: 5-8840-2039-0

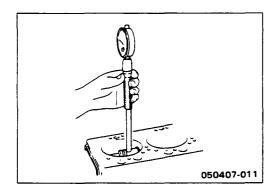
2. Use a bench press 2 to slowly force the cylinder liner from the cylinder body.

#### Note:

Take care not to damage the cylinder body upper face during the cylinder liner removal procedure.

3. Measure the cylinder body upper face warpage.

Refer to "Cylinder Body Upper Face Warpage".



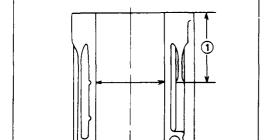


#### **Cylinder Liner Grade Selection**

Subtract the average cylinder body bore from the average cylinder liner outside diameter to obtain the fitting interference.

Fitting Interference	mm(in)
Standard	
-0.010* - 0.019 (-0.000 <del>4</del> * -	- 0.0007)

\* A minus (-) value indicates that the cylinder bore is larger than the linder outside diameter.





## **Cylinder Body Bore Measurement**

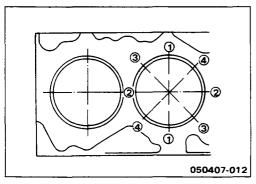
1. Take measurements at measuring point ① across positions ①-①, ②-②, ③-③, and ④-④.

Measuring Point ① 98 mm (3.86 in)

- 2. Calculate the average value of the four measurements to determine the correct cylinder grade.
- 3. Consult the following table with the resultant diameter for the correct liner application.

#### Selection

Liner Grade Size	2	3
Cyl. Bore	95.001 — 95.020	95.021 — 95.040





# Cylinder Liner Outside Diameter Measurement

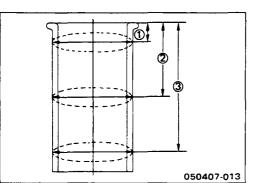
1. Take two measurements at measuring points ①, ②, and ③.

Measuring Point ① 20 mm (0.79 in) all 4J models

Measuring Point ② 80 mm (3.15 in) 4JA1 90 mm (3.54 in) 4JB1T

Measuring Point ③ 140 mm (5.50 in) 4JA1 160 mm (6.30 in) 4JB1T

2. Calculate the average value of the six measurements

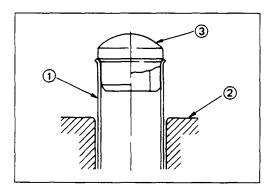


# Cylinder Bore and Cylinder Liner Outside Diameter Combination

(Reference)

mm(in)

Liner Grade	Cylinder Bore	Cylinder Liner Outside Diameter
1.	95.001 – 95.010 (3.74019 – 3.74054)	95.011 – 95.020 (3.74058 – 3.74094)
2.	95.011 – 95.020 (3.74058 – 3.74094)	95.021 - 95.030 (3.74098 - 3.74133)
3.	95.021 - 95.030 (3.74098 - 3.74133)	95.031 – 95.040 (3.74137 – 3.74172)
4.	95.031 – 95.040 (3.74137 – 3.74172)	95.041 – 95.050 (3.74176 – 3.74212)









# **Cylinder Liner Installation**

- 1. Cylinder Liner Installation Using The Special Tool
  - 1) Use new kerosene or diesel oil to thoroughly clean the cylinder liners and bores.
  - 2) Use compressed air to blow-dry the cylinder liner and bore surfaces.

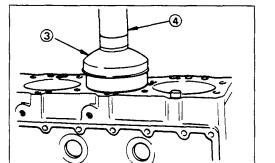
#### Note:

All foreign material must be carefully removed from the cylinder liner and the cylinder bore before installation.

- 3) Insert the cylinder liner ① into the cylinder body② from the top of the cylinder body.
- 4) Set the cylinder liner installer ③ to the top of the cylinder liner.

Cylinder Liner Installer: 5-8840-2040-0

5) ③ is directly beneath the bench press shaft center ④.





Check that the cylinder liner is set perpendicular to the bench press and that there is no wobble.

- 6) Use the bench press to apply a seating force of 500 kg (1,100 lb/4,900 N) to the cylinder liner.
- 7) Apply a force of 2,500 kg (5,500 lb/24,500 N) to fully seat the cylinder liner.
- 8) After installing the cylinder liner, measure the cylinder liner projection.

Refer to "Cylinder Liner Projection Inspection".

Cylinder Liner Installation Using Dry Ice
 Cylinder liner is a chrome plated dry type, it is advisable to use dry ice during the installation procedure.

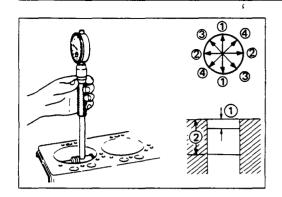
Cooling the cylinder liner with dry ice will cause the cylinder liner to contract, thus making installation easier.

#### Note:

It is important that the cylinder liner be inserted to the cylinder body immediately after it has been cooled.

# Warning:

Dry ice must be used with great care. Careless handling of dry ice can result in severe frostbite.





#### **Piston Grade Selection**

Measure the cylinder liner bore after installing the cylinder liner. Then select the appropriate piston grade for the installed cylinder liner.

1. Measure the cylinder liner bore.

Refer to "Cylinder Liner Bore Measurement".

Measuring Points ① 20 mm (0.8 in) for 4JA1 and 4JB1T

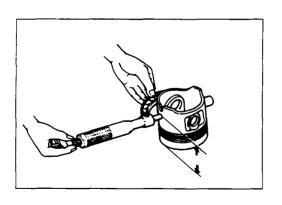
2 140 mm (5.5 in) for 4JA1

2 160 mm (6.3 in) for 4JB1T

Cylinder Liner Bore	mm(in)
Standard	Limit
93.021 — 93.060 (3.6622 — 3.6638)	93.100 (3.6653)

#### Note:

It is most important that the correct piston grade be used. Failure to select the correct piston grade will result in engine failure. Always measure the cylinder bore and select the correct piston grade.





#### 2. Measure the piston diameter.

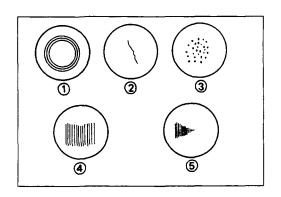
Piston Measuring Point: 70 mm (3.1 in) for 4JA1 74 mm (2.9 in) for 4JB1T

Piston Grade	mm(in)
Grade	Size
(A)	92.985 - 93.004 (3.6608 - 3.6615)
©	93.005 — 93.024 (3.6616 — 3.6623)

Cylinder Liner and Piston Clearance	mm(in)
0.025 — 0.045 (0.0010 — 0.0018)	

#### Note:

Cylinder liner kit clearances are preset. However, the cylinder liner installation procedure may result in slight decreases in cylinder liner clearances. Always measure the cylinder liner clearance after installation to be sure that it is correct.





#### **TAPPET AND PUSH ROD**

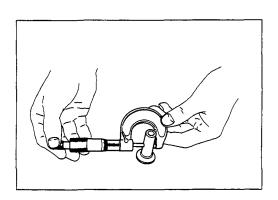
Visually inspect the tappet contact surfaces for pitting, cracking, and other abnormal conditions. The tappet must be replaced if any of these conditions are present.

Refer to the illustration at the left.

- ① Normal contact
- 2 Cracking
- 3 Pitting
- Irregular contact Uneven contact
- ⑤ Irregular contact One-sided contact

#### Note:

The tappet surfaces are spherical. Do not attempt to grind them with an oil stone or similar tool in an effort to repair the tappet. If the tappet is damaged, it must be replaced.

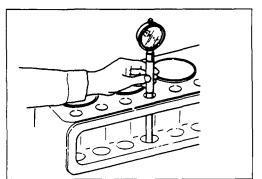




# **Tappet Outside Diameter**

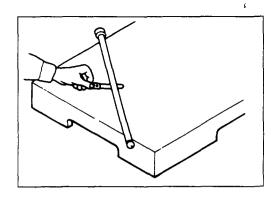
Measure the tappet outside diameter with a micrometer. If the measured value is less than the specified limit, the tappet must be replaced.

Fappet Outside Diameter	mm(in)
Standard	Limit
12.97 — 12.99 (0.510 — 0.511)	12.95 (0.510)





Tappet and Cylinder Body Clea	arance mm(in)
Standard	Limit
0.03 (0.001)	0.10 (0.004)





#### **Push Rod Curvature**

- 1. Lay the push rod on a surface plate.
- 2. Roll the push rod along the surface plate and measure the push rod curvature with a thickness gauge.

If the measured value exceeds the specified limit, the push rod must be replaced.

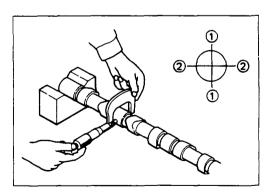
Pushrod Curvature	mm(in)
Limit	
0.3 (0.012)	

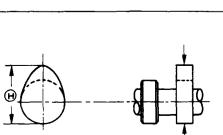


 Visually inspect both ends of the push rod for excessive wear and damage. The push rod must be replaced if these conditions are discovered during inspection.

#### **CAMSHAFT**

Visually inspect the journals, the cams, the oil pump drive gear, and the camshaft bearings for excessive wear and damage. The camshaft and the camshaft bearings must be replaced if these conditions are discovered during inspection.







#### **Camshaft Journal Diameter**

Use a micrometer to measure each camshaft journal diameter in two directions (① and ②). If the measured value is less than the specified limit, the camshaft must be replaced.

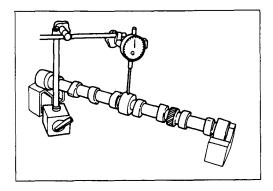
Camshaft Journal Diameter	mm(in)
Standard	Limit
49.945 — 49.975 (1.9663 — 1.9675)	49.60 (1.953)

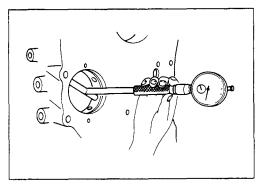


#### Cam Height

Measure the cam height (H) with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Cam Height (H)	mm(in)
Standard	Limit
42.08 (1.657)	41.65 (1.640)







#### Camshaft Run-Out

1. Mount the camshaft on V-blocks.

2. Measure the run-out with a dial indicator. If the measured value exceeds the specified limit, the camshaft must be replaced.

Camshaft Run-Out	mm(in)
Standard	Limit
0.02 (0.0008)	0.10 (0.004)



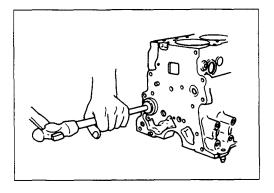
# **Camshaft and Camshaft Bearing Clearance**

Use an inside dial indicator to measure the camshaft bearing inside diameter.

Crankshaft Bearing Inside Dian	neter mm(in)
Standard	Limit
50.00 — 50.03 (1.968 — 1.970)	50.08 (1.972)

If the clearance between the camshaft bearing inside diameter and the journal exceeds the specified limit, the camshaft bearing must be replaced.

mm(in)
Limit
0.12 (0.005)



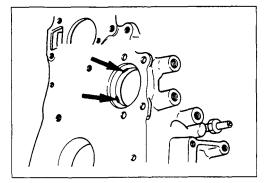


# **Camshaft Bearing Replacement Camshaft Bearing Removal**



- 1. Remove the cylinder body plug plate.
- 2. Use the bearing replacer to remove the camshaft bearing.

Bearing Replacer: 5-8840-2038-0









#### **Camshaft Bearing Installation**

- 1. Align the bearing oil holes with the cylinder body oil holes.
- 2. Use the replacer to install the camshaft bearing.

Bearing Replacer: 5-8840-2038-0



#### CRANKSHAFT AND BEARING

Inspect the surface of the crankshaft journals and crankpins for excessive wear and damage.

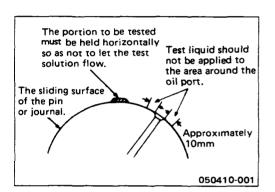
Inspect the oil seal fitting surfaces for excessive wear and damage.

Inspect the oil ports for obstructions.

#### Note:

To increase crankshaft strength, tufftriding (Nitrizing Treatment) has been applied. Because of this, it is not possible to regrind the crankshaft surfaces.

Therefore, under size bearing are not available.





#### **Crankshaft Tufftriding Inspection**

- Use an organic cleaner to thoroughly clean the crankshaft. There must be no traces of oil on the surfaces to be inspected.
- 2. Prepare a 5 10% solution of ammonium cuprous chloride (dissolved in distilled water).
- 3. Use a syringe to apply the solution to the surface to be inspected.

Hold the surface to be inspected perfectly horizontal to prevent the solution from running.

#### Note:

Do not allow the solution to come in contact with the oil ports and their surrounding area.



#### **Judgment**

1. Wait for thirty to forty seconds.

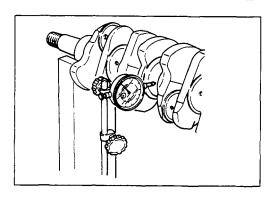
If there is no discoloration after thirty or forty seconds, the crankshaft is usable.

If discoloration appears (the surface being tested will become the color of copper), the crankshaft must be replaced.

2. Steam clean the crankshaft surface immediately after completing the test.

#### Note:

The ammonium cuprous chloride solution is highly corrosive. Because of this, it is imperative that the surfaces being tested be cleaned immediately after completing the test.





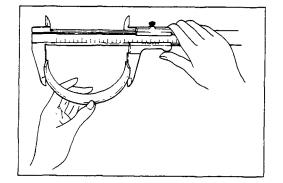
#### Crankshaft Run-Out

- 1. Set a dial indicator to the center of the crankshaft journal.
- 2. Gently turn the crankshaft in the normal direction of rotation.

Read the dial indicator as you turn the crankshaft.

If the measured value exceeds the specified limit, the crankshaft must be replaced.

mm(in	
Limit	
0.08 (0.003)	





# **Bearing Spread**

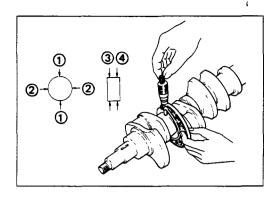
Rearing Spread

Use a vernier caliper to measure the bearing spread.

If the measured value is less than the specified limit, the bearing must be replaced.

mmlin

bearing opiead		(1111)
	L	imit
Crankshaft Bearing	4JA1	64.5 (2.54)
Crankshalt Bearing	4JB1T	74.5 (2.93)
Connecting Rod Bearing	56.5	5 (2.22)





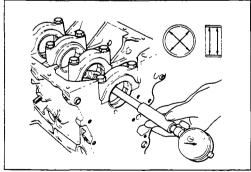
#### Crankshaft Journal and Crankpin Diameter

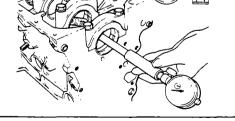
- 1. Use a micrometer to measure the crankshaft journal diameter across points  $\bigcirc -\bigcirc$  and  $\bigcirc -\bigcirc$ .
- 2. Use the micrometer to measure the crankshaft journal diameter at the two points (3 and 4).
- 3. Repeat Steps ① and ② to measure the crankpin diameter.

If the measured values are less than the specified limit, the crankshaft must be replaced.

Crankshaft Journal Diameter		mm(in	
	Standard	Limit	
4JA1	59.92 — 59.93 (2.3591 — 2.3594)	59.91 (2.3586)	
4JB1T	69.92 — 69.93 (2.7527 — 2.7531)	69.91 (2.7524)	

Crankpin Diameter	mm(in)	
Standard	Limit	
52.92 — 52.93 (2.0833 — 2.0839)	52.90 (2.083)	
Crankshaft Journal and Crankpii Uneven Wear	n mm(in)	
Standard	Limit	
0.05 (0.002) or less	0.08 (0.003)	



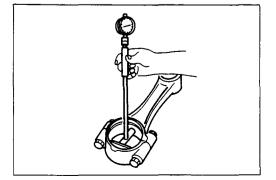




#### Crankshaft Journal and Bearing Clearance

If the clearance between the measured bearing inside diameter and the crankshaft journal diameter exceeds the specified limit, the bearing and/or the crankshaft must be replaced.

Crankshaft Journal and Bearing	g Clearance mm(in)
Standard	Limit
0.031 - 0.064 (0.0012 - 0.0025)	0.110 (0.0043)





#### **Connecting Rod Bearing Inside Diameter**

- 1. Install the bearing to the connecting rod big end.
- 2. Tighten the bearing cap to the specified torque.

Connecting Rod Bearing Cap Bolt

Torque		kg·m(lb.ft/N·m)
	8.5 ± 0.5 (61.5 ± 3.6/83.40 ±	± 4.90)

3. Use an inside dial indicator to measure the connecting rod bearing inside diameter.



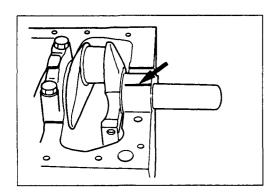
# Crankpin and Bearing Clearance

If the clearance between the measured bearing inside diameter and the crankpin exceeds the specified limit, the bearing and/or the crankshaft must be replaced.

Crankpin	and	Bearing	Clearance

mm(in)

Standard	Limit
0.029 — 0.066 (0.0011 — 0.0026)	0.100 (0.0039)

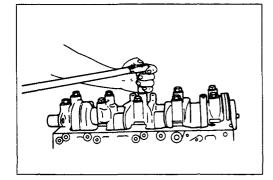




# Clearance Measurements (With Plastigage)

#### Crankshaft Journal and Bearing Clearance

- 1. Clean the cylinder body, the journal bearing fitting surface, the bearing caps, and the bearings.
- 2. Install the bearings to the cylinder body.
- 3. Carefully place the crankshaft on the bearings.
- 4. Rotate the crankshaft approximately 30° to seat the bearing.
- 5. Place the Plastigage (arrow) over the crankshaft journal across the full width of the bearing.
- 6. Install the bearing caps with the bearing.





7. Tighten the bearing caps to the specified torque.

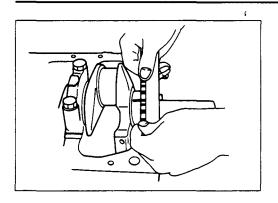
Crankshaft Bearing Cap Bolt Torque kg·m(lb

kg⋅m(lb.ft/N⋅m)

 $17 \pm 1 \ (123.0 \pm 7.2/166.7 \pm 9.8)$ 

Do not allow the crankshaft to turn during bearing cap installation and tightening.

8. Remove the bearing cap.





9. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

If the measured value exceeds the limit, perform the following additional steps.

- 1) Use a micrometer to measure the crankshaft outside diameter.
- 2) Use an inside dial indicator to measure the bearing inside diameter.

If the crankshaft journal and bearing clearance exceeds the limit, the crankshaft and/or the bearing must be replaced.

Crankshaft Journal and Bearing Clearance mm(in)

Standard	Limit
0.031 — 0.064 (0.0012 — 0.0025)	0.110 (0.0043)



# Crankpin and Bearing Clearance

- 1. Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
- 2. Install the bearing to the connecting rod and the bearing cap. Do not allow the crankshaft to move when installing the bearing cap.
- 3. Prevent the connecting rod from moving.
- 4. Attach the Plastigage to the crankpin. Apply engine oil to the Plastigage to keep it from falling.





5. Install the bearing cap and tighten it to the specified torque. Do not allow the connecting rod to move when installing and tightening the bearing cap.

 $kg \cdot m(lb.ft/N \cdot m)$ 

Connecting Rod Bearing Cap Bolt Torque

 $8.5 \pm 0.5$  (61.5 ± 3.6/83.35 ± 4.90)

- 6. Remove the bearing cap.
- 7. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

If the measured value exceeds the specified limit, perform the following additional steps.

- 1) Use a micrometer to measure the crankpin outside diameter.
- 2) Use an inside dial indicator to measure the bearing inside diameter.

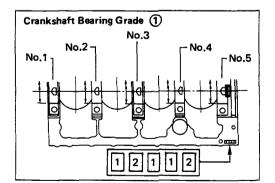
If the crank pin and bearing clearance exceeds the specified limit, the crankshaft and/or the bearing must be replaced.

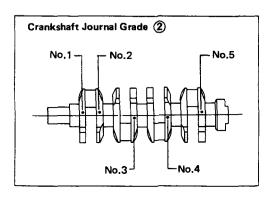
Crankpin and Bearing Clearand	ce mm(in)
Standard	Limit
0.029 — 0.066 (0.0011 — 0.0026)	0.100 (0.0039)

#### CRANKSHAFT BEARING SELECTION

Crankshaft bearing selection is based on the measured diameters of the crankshaft journals and the bearing inserts.

Match the crankshaft bearing housing grade marks and the crankshaft journal grade marks in the table below to determine the correct crankshaft bearing size.

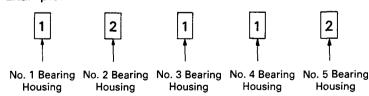




## **Crankshaft Bearing Housing Grade Mark Position**

Crankshaft bearing housing grade marks 1 or 2 are stamped on the rear right hand side of the cylinder body.

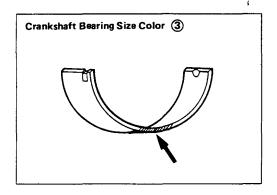
#### Example:



#### Crankshaft Journal Grade Mark Position

The crankshaft journal grade marks (1 or —) are stamped on each crankshaft journal wave.

The crankshaft journal and bearing clearance must be the same for each position after installation of the crankshaft and the crankshaft bearings.



#### REFERENCE 4JA1 ENGINE

# mm(in)

Crankshaft Bearing ①		Crankshaft Journal ②		Crankshaft Bearing	
Grade Mark	Diameter		Diameter	Size Color Code 3	
		1 or —	59.927—59.932 (2.3593-2.3595)	Black	
1	63.987-64.000 (2.5191-2.6196)	2 or — —	59.922-59.927 (2.3591-2.3593)	Blue	
		3 or ———	59.917-59.922 (2.3589-2.3591)	Diue	
2	63.975-63.987 (2.5186-2.5191)	1 or —	59.927—59.932 (2.3593-2.3595)	Green	
		2 or — —	59.922-59.927 (2.3591-2.3593)	Green	
		3 or 	59.917-59.922 (2.3589-2.3591)	Black	

#### **4JB1T ENGINE**

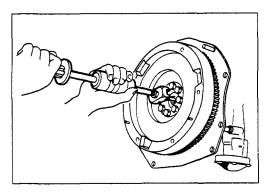
# mm(in)

Crani	kshaft Bearing ①	Crankshaft Journal ②		Crankshaft	
Grade Mark	Diameter	Grade Mark	Diameter	Bearing Size Color Code ③	
		1 or —	69.927—69.932 (2.7530-2.7532)	Black	
1	73.987-74.000 (2.9129-2.9134)	2 or — —	69.922-69.927 (2.7528-2.7530)	Blue	
		3 or 	69.917-69.922 (2.7556-2.7528)	Blue	
2	73.975-73.987 (2.9124-2.9129)	1 or 	69.927—69.932 (2.7530-2.7532)	Green	
		2 or — —	69.922-69.927 (2.7528-2.7530)	Gleen	
		3 or 	69.917-69.922 (2.7556-2.7528)	Black	



#### **CRANKSHAFT PILOT BEARING**

Check the crankshaft pilot bearing for excessive wear and damage and replace it if necessary.





# **Crankshaft Pilot Bearing Replacement**

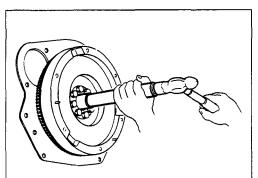
## **Crankshaft Pilot Bearing Removal**



Use the pilot bearing remover to remove the crankshaft pilot bearing.

Pilot Bearing Remover: 5-8840-2000-0

Sliding Hammer: 5-8840-0019-0 (J-23907)





# ۱ ۱

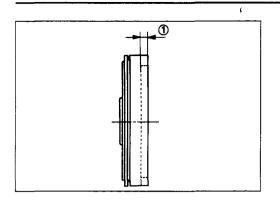
# **Crankshaft Pilot Bearing Installation**

- 1. Place the crankshaft pilot bearing right angle across the crankshaft bearing installation hole.
- Tap around the edges of the crankshaft pilot bearing outer races with a brass hammer to drive the bearing into the crankshaft bearing installation hole.

Pilot Bearing Installer: 5-8522-0024-0

#### Note:

Strike only the crankshaft pilot bearing outer race with the hammer. Do not strike the bearing inner race. Bearing damage and reduced bearing service life will result.





#### **FLYWHEEL AND RING GEAR**

#### **Flywheel**

- 1. Inspect the flywheel friction surface for excessive wear and heat cracks.
- 2. Measure the flywheel friction surface depth.

If the measured value is within the specified limit, the flywheel may be reground.

If the measured value exceeds the specified limit, the flywheel must be replaced.

Flywheel F	riction	Surface	Depth (	①
------------	---------	---------	---------	---

mm(in)

	Standard	Limit
4JA1	20 (0.787)	21 (0.827)
4JB1T	14 (0.551)	15 (0.591)

|--|

mm(in)

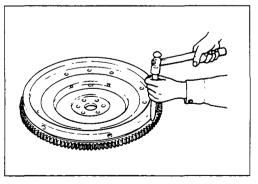
Less than 0.006 (0.00024)



#### Ring Gear

Inspect the ring gear.

If the ring gear teeth are broken or excessively worn, the ring gear must be replaced.

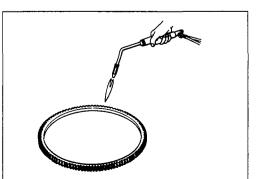




# **Ring Gear Replacement**

# **Ring Gear Removal**

Strike around the edges of the ring gear with a hammer and chisel to remove it.





#### Ring Gear Installation

1. Heat the ring gear evenly with a gas burner to invite thermal expansion.

Do not allow the temperature of the gas burner to exceed 200°C (390°F).

2. Install the ring gear when it is sufficiently heated.

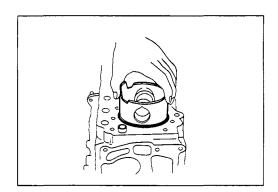
The ring gear must be installed with the chamfer facing the clutch.



#### **PISTON**

# Piston Grade Selection and Cylinder Bore Measurement

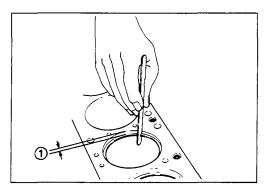
Refer to the Section "CYLINDER BODY", Item "Cylinder Liner Bore Measurement" for details on piston grade selection and cylinder liner bore measurement.



#### **PISTON RING**

#### **Piston Ring Gap**

 Insert the piston ring horizontally (in the position it would assume if it were installed to the piston) into the cylinder liner.



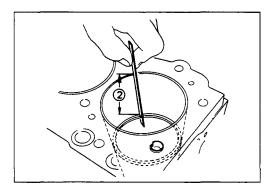
2. Push the piston ring into the cylinder bore until it reaches the measuring point ① or ② where the cylinder liner bore is the smallest.

Do not allow the piston ring to slant to one side or the other. It must be perfectly horizontal.

Measuring Point ① 10 mm (0.4 in)

or

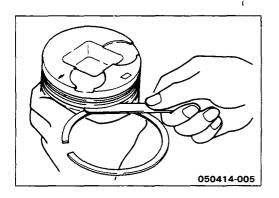
Measuring Point 2 120 mm (4.7 in)





 Use a feeler gauge to measure the piston ring gap.
 If the measured value exceeds the specified limit, the piston ring must be replaced.

Piston Ring Gap	mm(in)		
	Standard	Limit	
1st Compression Ring	0.2 - 0.4		
2nd Compression Ring	(0.008 — 0.016)	1.5	
Oil Ring	0.1 - 0.3 (0.004 - 0.012)	(0.059)	





#### Piston Ring and Piston Ring Groove Clearance

Use a feeler gauge to measure the clearance between the piston ring and the piston ring groove at several points around the piston.

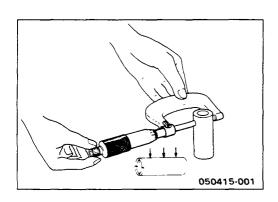
If the clearance between the piston ring and the piston ring groove exceeds the specified limit, the piston ring must be replaced.

Piston Ring and Piston Ring Groove

Clearance	mm(in)		
	Standard	Limit	
1st Compression Ring	0.09-0.125 (0.0035-0.0049)		
2nd Compression Ring	0.05-0.075 (0.002-0.003)	0.150 (0.006)	
Oil Ring	0.03-0.070 (0.0012-0.0028)		

4. Visually inspect the piston rings.

If a piston ring groove is damaged or distorted, the piston must be replaced.





#### **PISTON PIN**

#### **Piston Pin Diameter**

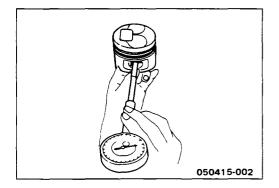
Use a micrometer to measure the piston pin diameter at several points.

If the measured value is less than the specified limit, the piston pin must be replaced.

Piston	Pin	Diam	eter

mm(in)

	Standard	Limit
4JA1	30.995 — 31.000 (1.2202 — 1.2204)	30.97 (1.219)
4JB1T	33.994 — 34.000 (1.3383 — 1.3386)	33.97 (1.337)



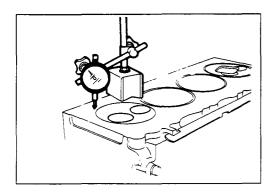


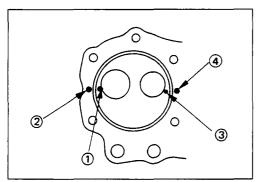
#### **Piston Pin and Piston Clearance**

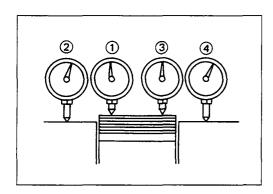
Use an inside dial indicator to measure the piston pin hole (in the piston).

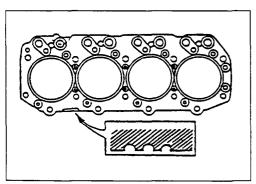
Piston Pin Hole	mm(in)
	Standard
4JA1	31.002 - 31.010 (1.2206 - 1.2208)
4JB1T	34.002 - 34.010 (1.3387 - 1.3390) (1.3383 - 1.3386)

Piston Pin and Piston Pin Hole Clearance	mm(in)
0.002 - 0.015 (0.00008 - 0.0006)	









#### CYLINDER HEAD GASKET SELECTION

Cylinder head gasket is determined by the piston head projection from the cylinder body upper surface, in order to improve engine performance.

Three types of gasket are provided by the difference of thickness. Select the adequet one out of three grades of gasket, according to the following procedure.



Before measurement, clear off carbon from the piston head and cylinder body surface and also clean the place where a gasket was installed.

#### **Piston Head Projection Measuring Point**

- Use a dial indicator to measure the piston projection amount.
- 2. Refer to the illustration for the piston head projection measuring positions.

All measuring positions should be as close as possible to the cylinder liner.



- 3. Measure the points ① ② ③ ④ and obtain two differences ①-② and ③-④ on each cylinder.

  Calculate the average value of the piston head projection on each cylinder.
- 4. Obtain the maximum value in the four cylinders.

Cylinder Head Gasket Grade Combination

5. Determine the gasket grade required to the maximum value described above in accordance with the following table.

mm(in)

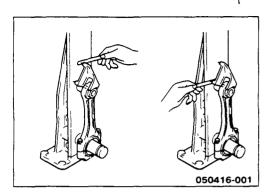
(0.063)

-,	,					
Gasket Grade Mark		Piston Projection		Gasket Thickness		
		4JA1	4JB1T	(Reference)		
<b>(A)</b>	m			0.718-0.773 (0.0283-0.0304)	0.758-0.813 (0.0298-0.0320)	1.50 (0.059)
B	m	77///		0.773-0.819 (0.0304-0.0322)	0.813-0.859 (0.0320-0.0338)	1.55 (0.061)
	7 2	72	17	0.819-0.874	0.859-0.914	1.60

#### Note:

Difference of the each piston projection and must be equal or within 0.1 mm (0.004 in).

| TT | TT | (0.0322-0.0344) | (0.0338-0.0360)





#### **CONNECTING ROD**

#### **Connecting Rod Alignment**

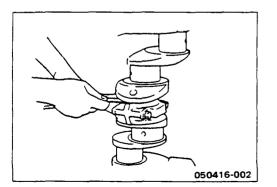
Use a connecting rod aligner to measure the distortion and the parallelism between the connecting rod big end hole and the connecting rod small end hole.

If either the measured distortion or parallelism exceed the specified limit, the connecting rod must be replaced.

#### Connecting Rod Alignment

Per	Length	of 100	mm (3.94 in)	mm(in)

	Standard	Limit
Distortion	0.08 or Less (0.003)	0.20 (0.008)
Parallelism	0.05 or Less (0.002)	0.15 (0.006)





#### **Connecting Rod Side Face Clearance**

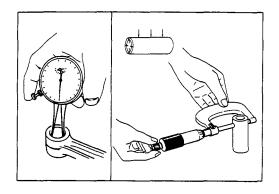
- 1. Install the connecting rod to the crankpin.
- Use a feeler gauge to measure the clearance between the connecting rod big end side face and the crankpin side face.

If the measured value exceeds the specified limit, the connecting rod must be replaced.

Connecting Rod Big End and Crankpin Side Face Clearance

_	n				ſ	:		
- 1	11	ì	ĭ	ı	١	6	١	ı

Standard	Limit
0.23 (0.009)	0.35 (0.014)





# Piston Pin and Connecting Rod Small End Bushing Clearance

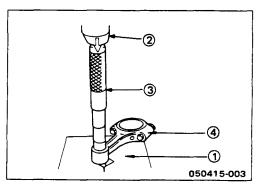
Use a caliper calibrator and a dial indicator to measure the piston pin and connecting rod small end bushing clearance.

If the clearance between the piston pin and the connecting rod small end bushing exceeds the specified limit, replace the piston pin and/or the connecting rod bushing.

Piston Pin and Connecting Rod Small End Bushing Clearance

mm(in)

bushing olduranoc	***************************************
Standard	Limit
0.008 - 0.020 (0.0003 - 0.0008)	0.050 (0.002)



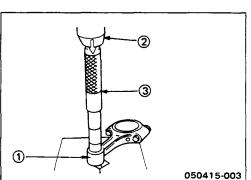


# Connecting Rod Bushing Replacement Connecting Rod Bushing Removal

- Set the connecting rod small end to the bench press V-block (1).
- 2. Use the bench press 2 and the bar 3 to slowly force the bushing from the connecting rod 4.

#### Note:

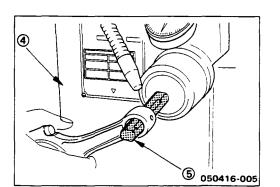
Take care not to damage the connecting rod with the bar when removing the bushing.



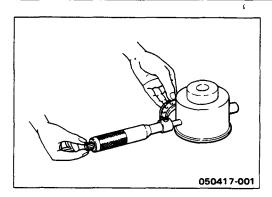


#### **Connecting Rod Bushing Installation**

- 1. Set the connecting rod small end ① to the bench press V-block.
  - The connecting rod must be perfectly horizontal.
- 2. Use the bench press 2 and the bar 3 to slowly force the bushing with oil hole into position.



3. Use a pin hole grinder 4 fitted with a reamer 5 to ream the piston pin hole.





# **IDLER GEAR SHAFT AND IDLER GEAR**

# Idler Gear Shaft Outside Diameter

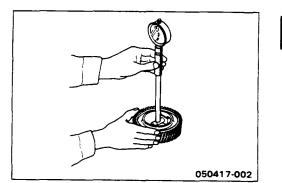
Use a micrometer to measure the idler gear shaft outside diameter.

If the measured value is less than the specified limit, the idler gear must be replaced.

 Idler Gear Shaft Outside Diameter
 mm(in)

 Standard
 Limit

 44.945 – 44.975
 44.845 (1.766)





# Idler Gear "A" Inside Diameter

(1.769 - 1.770)

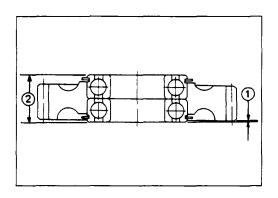
1. Use an inside dial indicator or an inside micrometer to measure the idler gear inside diameter.

Idler Gear Inside Diameter	mm(in	
Standard	Limit	
45.0 – 45.03 (1.7717 – 1.7718)	45.10 (1.7756)	

If the clearance between the idler gear shaft outside diameter and the idler gear inside diameter exceeds the limit, the idler gear must be replaced.

ilmit, the idler gear must be replaced.	
Idler Gear Shaft and Idler Gear Clearance	mm(in)

Standard	Limit
0.025 - 0.085 (0.0010 - 0.0033)	0.200 (0.008)





Idler Gear "B"

**Bearing Replacement** 

# Bearing Removal

Use a bench press or a hammer and a bar to remove the bearing from the idler gear.

# **Bearing Installation**

Use a bench press and bar to install the bearing into the idler gear.

Bearing Projection an	d Height	mm(in)
Projection ①	0.4 - 0.6 (0.016 -	0.024)
Height ②	23.7 — 24.0 (0.933 -	- 0.945)

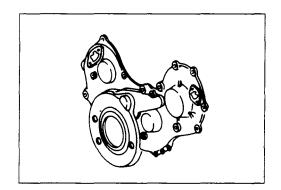
#### Note:

The bench press and bar should make contact only with the bearing outer races. Do not allow them to make contact with the bearing inner races.

Bearing damage and reduced bearing service life will result.



Replace the crankshaft front oil seal if it is excessively worn or damaged.



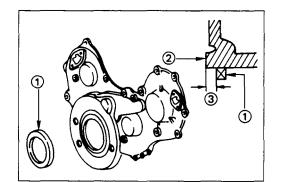


# Crankshaft Front Oil Seal Replacement

#### Oil Seal Removal

Use a plastic hammer and a screwdriver to tap around the oil seal to free it from the gear case cover.

Take care not to damage the oil seal lip surfaces.





#### Oil Seal Installation

Use the installer to install the front oil seal ① to the gear case cover ②.

Oil Seal Installer: 5-8840-2061-0

Note the oil seal installation depth 3 shown in the illustration.

Depth 3 = 1 mm (0.039 in.)

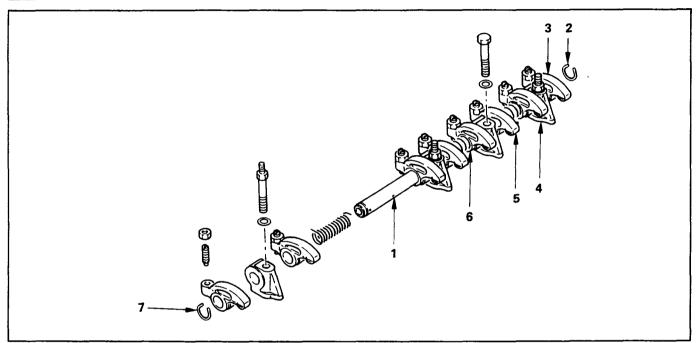




# INTERNAL PARTS MINOR COMPONENTS



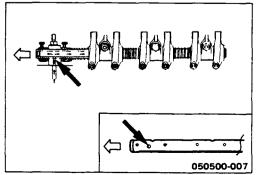
# **ROCKER ARM SHAFT AND ROCKER ARM**



# **Reassembly Steps**

- ▲ 1. Rocker arm shaft
  - 2. Rocker arm shaft snap ring
  - 3. Rocker arm
  - 4. Rocker arm shaft bracket

- 5. Rocker arm
- 6. Rocker arm shaft spring
- 7. Rocker arm shaft snap ring



# $\sqrt{V}$

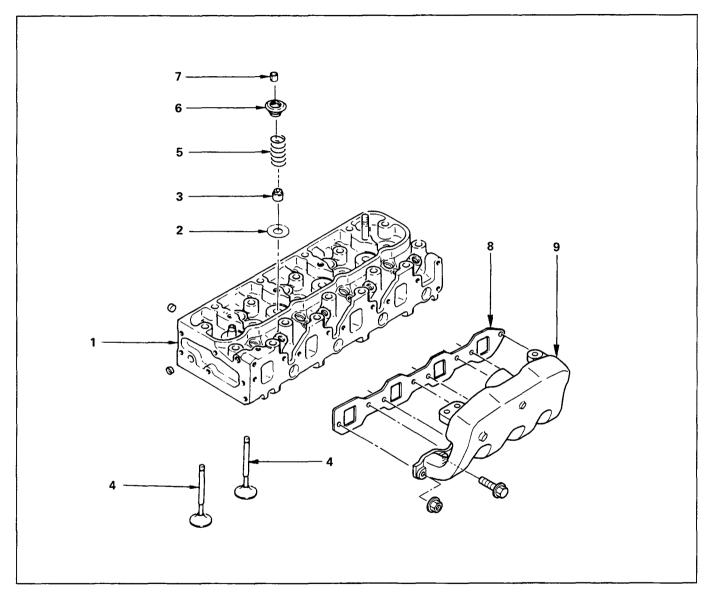
# **Important Operations**

#### 1. Rocker Arm Shaft

- 1) Position the rocker arm shaft with the large oil hole  $(4\phi)$  facing the front of the engine.
- 2) Install the rocker arm shaft together with the rocker arm, the rocker arm shaft bracket, and the spring.



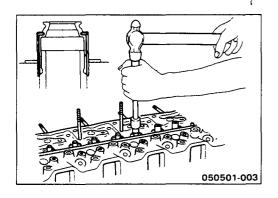
# CYLINDER HEAD



# **Reassembly Steps**

- 1. Cylinder head
- 2. Valve spring lower seat
- ▲ 3. Valve stem oil seal
- ▲ 4. Intake and exhaust valve
- ▲ 5. Valve spring

- 6. Valve spring upper seat
- ▲ 7. Split collar
- ▲ 8. Intake manifold gasket
- ▲ 9. Intake manifold

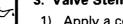




# **Important Operations**



# 3. Valve Stem Oil Seal



Apply a coat of engine oil to the oil seal inner face.
 Use an oil seal installer to install the oil seal to the oil

2) Use an oil seal installer to install the oil seal to the valve guide.

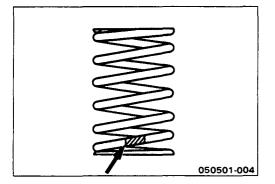
Oil Seal Installer: 5-8840-2033-0



#### 4. Intake and Exhaust Valve

- 1) Apply a coat of engine oil to each valve stem before installation.
- 2) Install the intake and exhaust valves.
- 3) Turn the cylinder head up to install the valve springs.

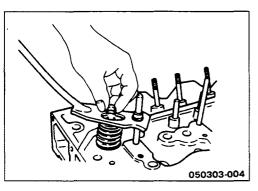
Take care not to allow the installed valves to fall free.





# 5. Valve Spring

Install the valve spring with their fine pitched end (painted) facing down.



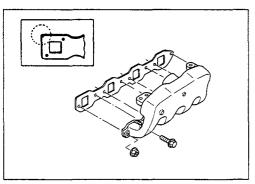


# 7. Split Collar

1) Use the spring compressor to compress the valve spring into position.

Spring Compressor: 9-8523-1423-0 (J-29760)

- 2) Install the split collars to the valve stem.
- Set the split collars by tapping around the head of the collar with a rubber hammer.





# 8. Intake Manifold Gasket

#### 9. Intake Manifold



- 1) Install the manifold gasket with the end having the sharp corners facing the front of the engine.
- Install the lower intake manifold to the cylinder head.
- 3) Tighten the manifold bolts to the specified torque.

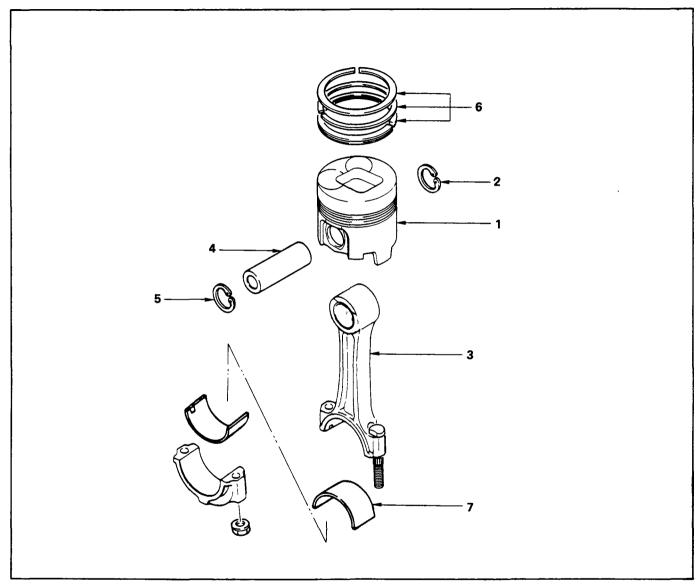
Manifold Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6 / 18.62 \pm 4.90)$ 



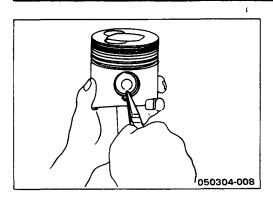
# **PISTON AND CONNECTING ROD**



# **Reassembly Steps**

- ▲ 1. Piston
- ▲ 2. Piston pin snap ring
- ▲ 3. Connecting rod
- ▲ 4. Piston pin

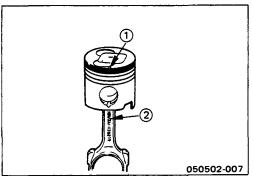
- ▲ 5. Piston pin snap ring
- 6. Piston ring
- ▲ 7. Connecting rod bearing





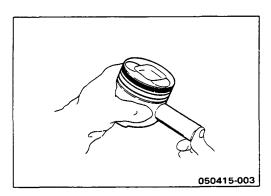
# **Important Operations**

- 1. Piston
- 2. Piston Pin Snap Ring
- 3. Connecting Rod
  - Clamp the connecting rod in a vise.
     Take care not to damage the connecting rod.
- 2) Use a pair of pliers to install the piston pin snap ring to the piston.





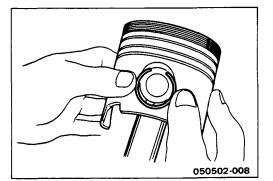
Install the piston to the connecting rod so that the piston head front mark 1 and the connecting rod "ISUZU" casting mark 2 are facing in the same direction.





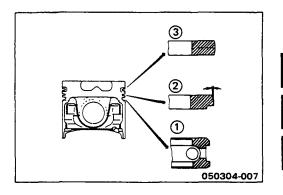
#### 4. Piston Pin

- 1) Apply a coat of engine oil to the piston pin and the piston pin hole.
- 2) Use your fingers to force the piston pin into the piston until it makes contact with the snap ring.



# 5. Piston Pin Snap Ring

- 3) Use your fingers to force the piston pin snap ring into the piston snap ring groove.
- 4) Check that the connecting rod moves smoothly on the piston pin.





1) Use a piston ring replacer to install the three piston rings.

Piston Ring Replacer

Install the piston rings in the order shown in the illustration.

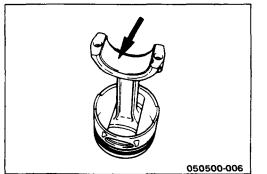
- 1 Oil ring
- 2 2nd compression ring
- 3 1st compression ring

#### Note:

Install the compression rings with the stamped side facing up.

Insert the expander coil into the oil ring groove so that there is no gap on either side of the expander coil before installing the oil ring.

- 2) Apply engine oil to the piston ring surfaces.
- 3) Check that the piston rings rotate smoothly in the piston ring grooves.



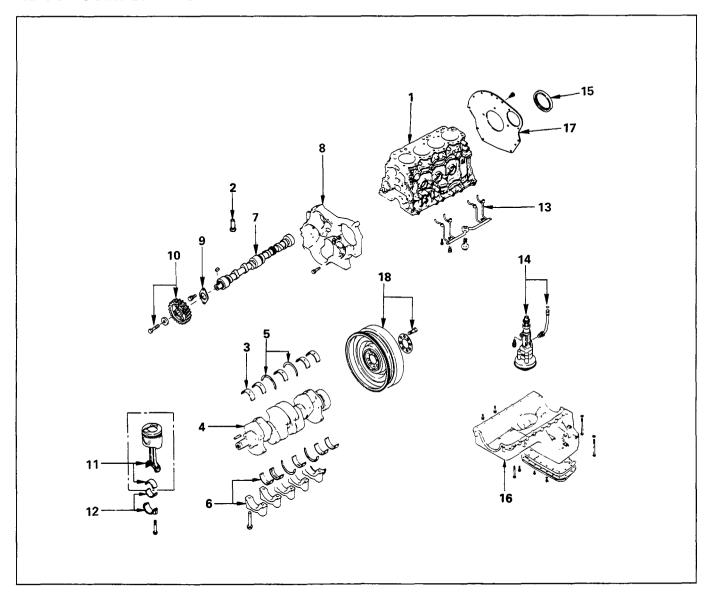


# 7. Connecting Rod Bearing

Carefully wipe any oil or other foreign material from the connecting rod bearing back face and the connecting rod bearing fitting surface.

# 

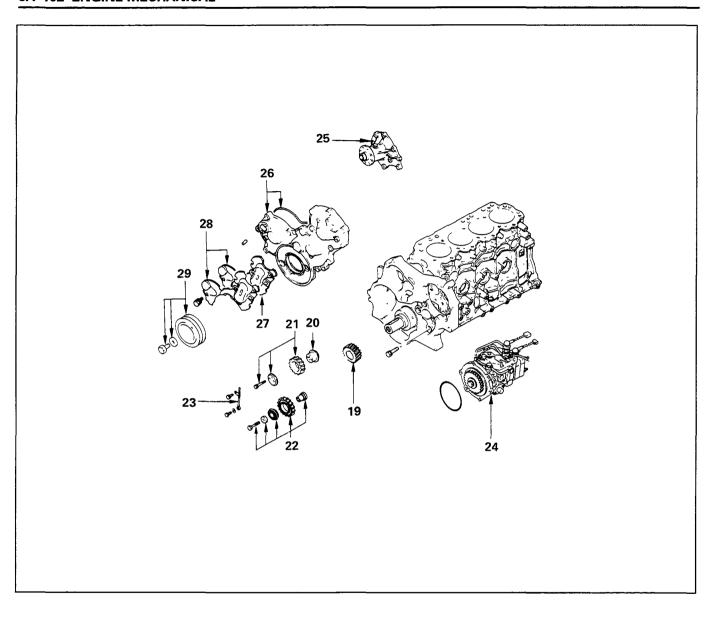
# **MAJOR COMPONENTS**



## **Reassembly Steps-1**

- 1. Cylinder body
- 2. Tappet
- 3. Crankshaft upper bearing
- 4. Crankshaft
- 5. Crankshaft thrust bearing
- ▲ 6. Crankshaft bearing cap with lower bearing
- ▲ 7. Camshaft
- ▲ 8. Timing gear case
- ▲ 9. Camshaft thrust plate
- ▲ 10. Camshaft timing gear

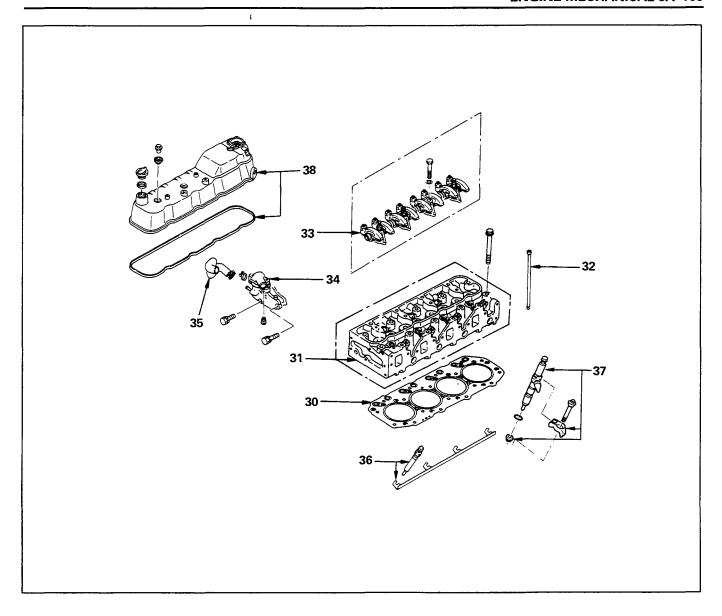
- ▲ 11. Piston and connecting rod with upper bearing
- ▲ 12. Connecting rod bearing cap with lower bearing
- ▲ 13. Piston cooling oil pipe
- ▲ 14. Oil pump with oil pipe
- ▲ 15. Crankshaft rear oil seal
- ▲ 16. Oil pan
- ▲ 17. Cylinder body rear plate
  - 18. Flywheel



# **Reassembly Steps-2**

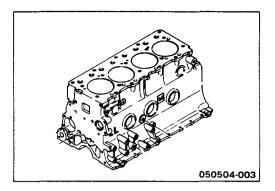
- ▲ 19. Crankshaft timing gear
- ▲ 20. Idler gear shaft
- ▲ 21. Idler gear "A"
- ▲ 22. Idler gear "B" and shaft
- ▲ 23. Timing gear oil pipe
- ▲ 24. Injection pump
- ▲ 25. Water pump
- ▲ 26. Timing gear case cover
  - 27. Space rubber

- 28. Gear case cover upper cover and lower cover
- ▲ 29. Crankshaft damper pulley



# Reassembly Steps-3

- lacktriangle 30. Cylinder head gasket
- ▲ 31. Cylinder head
  - 32. Push rod
- ▲ 33. Rocker arm shaft and rocker arm
- ▲ 34. Thermostat housing with thermo switch
- 35. Water by-pass hose
- ▲ 36. Glow plug and glow plug connector
- ▲ 37. Injection nozzle holder
- ▲ 38. Cylinder head cover



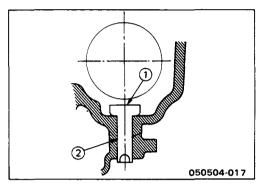
# $\nabla$

# **Important Operations**



# 1. Cylinder Body

Use compressed air to thoroughly clean the inside and outside surfaces of the cylinder body, the oil holes, and the water jackets.



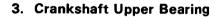


## 2. Tappet

- 1) Apply a coat of engine oil to the tappet (1) and the cylinder body tappet insert holes (2).
- 2) Locate the position mark applied at disassembly (if the tappet is to be reused).

#### Note:

The tappet must be installed before the camshaft installation.



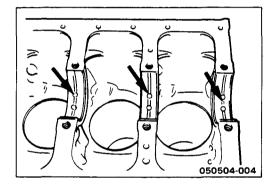
The crankshaft upper bearings have an oil hole and an oil groove. The lower bearings do not.

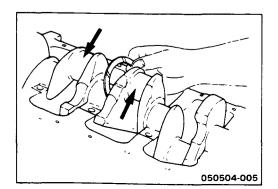
1) Carefully wipe any foreign material from the upper bearing.

# Note:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surfaces.

2) Locate the position mark applied at disassembly if the removed upper bearings are to be reused.

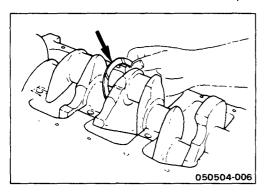






#### 4. Crankshaft

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft.



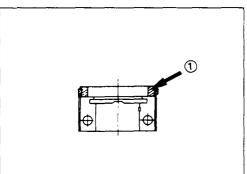


# 5. Crankshaft Thrust Bearing

Apply an ample coat of engine oil to the thrust bearings before installation.

Install the thrust bearings to the crankshaft center journal.

The thrust bearing oil grooves must be facing the sliding faces.

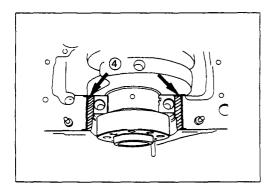




# 6. Crankshaft Bearing Cap with Lower Bearing

Before the crankshaft bearing installation, select the appropriate bearings in accordance with the description in CRANK BEARING SELECTION of INSPECTION AND REPAIR.

1) Apply the recommended liquid gasket or its equivalent to the No. 5 crankshaft bearing cap 1 as shown in the illustration.



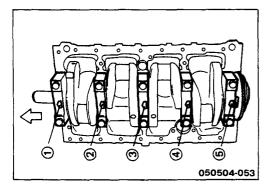


2) Apply the recommended liquid gasket or its equivalent to the No. 5 crankshaft bearing cap cylinder body fitting surfaces at the points 4 shown in the illustration.

#### Note:

Be sure that the bearing cap fitting surface is completely free of oil before applying the liquid gasket.

Do not allow the liquid gasket to obstruct the cylinder thread holes and bearings.

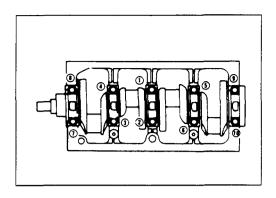






- 4) Install the bearing caps with the bearing cap head arrow mark facing the front of the engine.
  - The bearing cap numbers must be facing up.
- 5) Apply engine oil to the crankshaft bearing cap bolts.
- 6) Temporarily tighten the bearing cap bolts.

The bolts will be tightened to the specified torque after the crankshaft rear oil seal is installed.





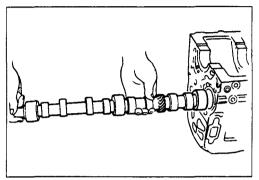
7) Tighten the crankshaft bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

Crankshaft Bearing Cap Torque

kg·m(lb.ft/N·m)

 $17 \pm 1 (123.0 \pm 7.2 / 166.7 \pm 9.8)$ 

8) Check to see the crankshaft turns smoothly by rotating it manually.



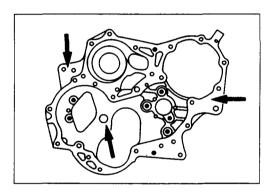


#### 7. Camshaft

1) Apply a coat of engine oil to the camshaft and the camshaft bearings.

Install the camshaft to the cylinder body.

Take care not to damage the camshaft bearings.





# 8. Timing Gear Case

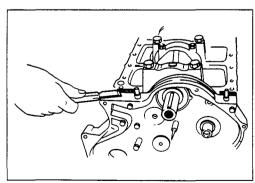
1) Tighten the timing gear case with timing gear case gasket to the specified torque.

Timing Gear Case Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6 / 18.6 \pm 4.9)$ 

2) Cut away the flash from the gasket.







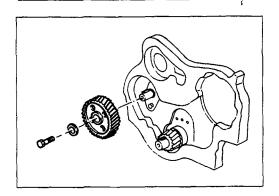
#### 9. Camshaft Thrust Plate

Install the thrust plate to the cylinder body and tighten the thrust plate bolts to the specified torque.

Thrust Plate Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.8 \pm 0.5 (13.0 \pm 3.6 / 17.6 \pm 4.9)$ 





# 10. Camshaft Timing Gear

1) Install the camshaft timing gear to the camshaft.

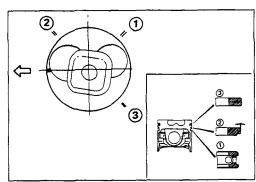
The timing gear mark ("Y - Y") must be facing outward.

2) Tighten the timing gear to the specified torque.

Timing Gear Bolt Torque

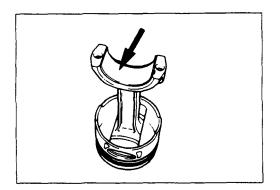
 $kg \cdot m(lb.ft/N \cdot m)$ 

 $11.0 \pm 1 (79.6 \pm 7.2 / 107.8 \pm 9.8)$ 





- 11. Piston and Connecting Rod with Upper Bearing
- 12. Connecting Rod Bearing Cap with Lower Bearing
- 1) Apply a coat of engine oil to the circumference of each piston ring and piston.
- 2) Position the piston ring gaps as shown in the illustration.
  - ① Oil ring
  - 2 2nd Compression ring
  - 3 1st Compression ring

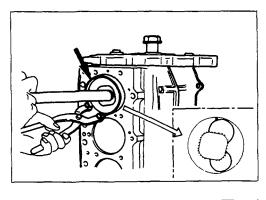




3) Apply a coat of molybdenum disulfide grease to the two piston skirts.

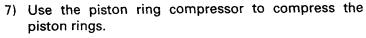
This will facilitate smooth break-in when the engine is first started after reassembly.

- 4) Apply a coat of engine oil to the upper bearing surfaces.
- 5) Apply a coat of engine oil to the cylinder wall.





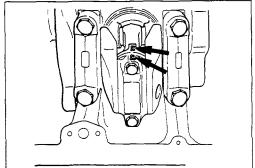
6) Position the piston head front mark so that it is facing the front of the engine.



Piston Ring Compressor: 5-8840-9018-0 (J-8037)

8) Use a hammer grip to push the piston in until the connecting rod makes contact with the crankpin.

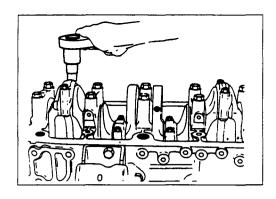
At the same time, rotate the crankshaft until the crankpin is at BDC.





Align the bearing cap cylinder number marks and the connecting rod cylinder number marks.

The cylinder number marks must be turned toward the exhaust manifold.





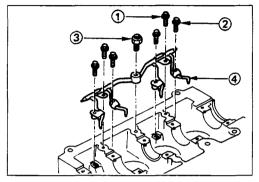
10) Apply a coat of engine oil to the threads and setting faces of each connecting rod cap bolt.

11) Tighten the connecting rod caps to the specified torque.

Connecting Rod Bearing Cap Bolt

Torque kg·m(lb.ft/N·m)

 $8.5 \pm 0.5 (61.5 \pm 3.6 / 83.3 \pm 4.9)$ 





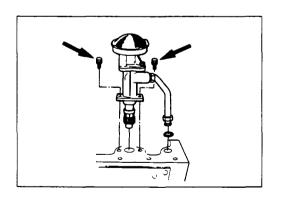
# 13. Piston Cooling Oil Pipe

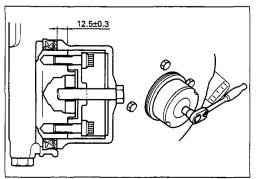
- 1) Install the piston cooling oil pipe to the cylinder body.
- 2) Tighten the oil pipe bolts and relief valve to the specified torque.

kg·m(lb.ft/N·m)
$1.9\pm 0.5 (13.7 \pm 3.6 / 14.7 \pm 4.9)$
$0.8 \pm 0.2 (5.1 \pm 1.4 / 7.8 \pm 2.0)$
kg·m(lb.ft/N·m)
$3.0\pm0.5$ (21.7 $\pm$ 3.6 / 29.4 $\pm$ 4.9)

#### Note:

Check that there is no interference between the piston and the oiling jet pipe 4 by slowly rotating the crankshaft.







#### 14. Oil Pump with Oil Pipe

Install the oil pump with the oil pipe and tighten the bolts to the specified torque.

Oil Pump Bolt Torque	kg-m(lb.ft/N·m)
1.9 ± 0.5 (13.7	± 3.6 / 18.6 ± 4.9)

#### Note:

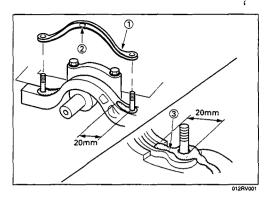
Take care not to damage the O-rings when tightening the oil pipe bolts.



#### 15. Crankshaft Rear Oil Seal

Use a oil seal installer to install the crankshaft rear oil seal.

Oil Seal Installer: 5-8840-2359-0





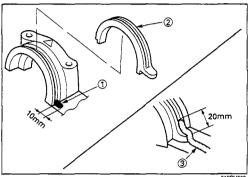
#### 16. Oil Pan

1) Apply the recommended liquid gasket or its equivalent to arch gasket fitting surface as shown in the illustration.



2) Install the oil pan front gasket 1 to the timing gear case arches.

The gasket projection 2 must be facing forward.



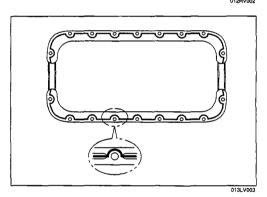


3) Install the rear arch gasket 2 to the No. 5 bearing cap.
Use your fingers to push the arch gasket into the bearing cap groove.

Take care not to scratch the arch gasket outer surface.



Also apply the recommended liquid gasket or its equivalent to arch gasket fitting area as indicated in the illustration.

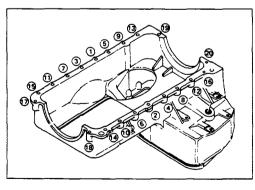




4) Apply the recommended liquid gasket or its equivalent to groove of the oil pan fitting surface as shown in the illustration.

#### Note:

Be sure that the oil pan fitting surface is completely free of oil and dust before applying the liquid gasket.



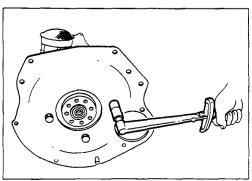


- 5) Install the oil pan to the cylinder body.
- 6) Tighten the oil pan bolts to the specified torque a little at a time in the sequence shown in the illustration.

Oil Pan Bolt Torque

kg·m(lb.ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6 / 18.6 \pm 4.9)$ 





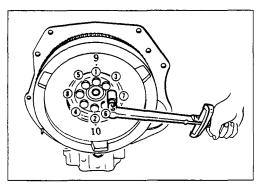
#### 17. Cylinder Body Rear Plate

- Align the rear plate with the cylinder body knock pins.
- 2) Tighten the rear plate to the specified torque.

Rear Plate Torque

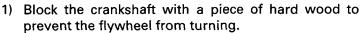
kg⋅m(lb.ft/N⋅m)

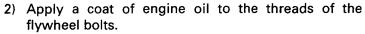
 $8.4 \pm 0.8 (60.7 \pm 5.8 / 82.3 \pm 7.8)$ 

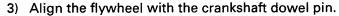




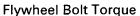
# 18. Flywheel





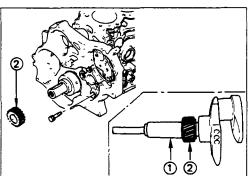


4) Tighten the flywheel bolts to the specified torque in the numerical order shown in the illustration.



 $kg \cdot m(lb.ft/N \cdot m)$ 

 $12.0 \pm 0.5 (86.8 \pm 3.6 / 117.6 \pm 4.9)$ 



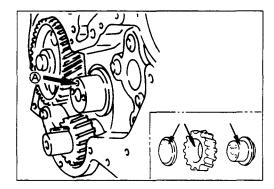


# 19. Crankshaft Timing Gear

Use the crankshaft timing gear installer ① to install the crankshaft timing gear 2.

The crankshaft timing gear setting mark ("X-X") must be facing outward.

Crankshaft Timing Gear Installer: 9-8522-0020-0



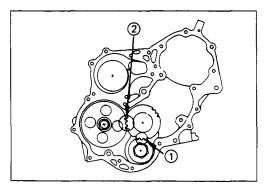
# 20. Idler Gear Shaft

#### 21. Idler Gear "A"

1) Apply engine oil to the idler gear and the idler gear shaft.

The idler gear shaft oil hole @ must be facing up.

2) Position the idler gear setting marks "X" and "Y" so that they are facing the front of the engine.









- 3) Align the idler gear "X" setting mark with the crankshaft timing gear ① "X-X" setting mark.
- 4) Align the idler gear "Y" setting mark with the camshaft timing gear 2 "Y-Y" setting mark.
- 5) Install the thrust collar and bolts to the cylinder body through the shaft.

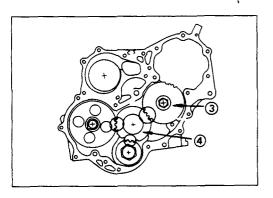
The thrust collar oil hole must be facing up, and the thrust collar chamfered must be outward.

6) Tighten the idler gear bolt to the specified torque.

Idler Gear "A" Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 





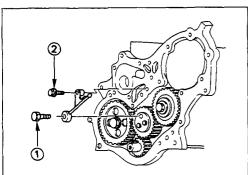
# 22. Idler Gear "B" and Shaft

- 1) Apply engine oil to the idler gear and the idler gear shaft.
- 2) Align the idler gear "B" ③ "Z" setting mark with the idler gear "A" ④ "Z-Z" setting mark.
- 3) Tighten the idler gear bolt to the specified torque.

Idler Gear "B" Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $11.0 \pm 1.0 (79.6 \pm 7.2/107.8 \pm 9.8)$ 





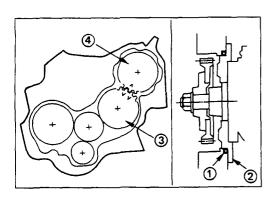
# 23. Timing Gear Oil Pipe

- Install the oil pipe to the timing gear case and idler gear "A".
- 2) Tighten the oil pipe eye bolt ① and bolt ② to the specified torque.

Eye Joint and Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.25 \pm 0.25 \ (9.0 \pm 1.8/12.3 \pm 2.5)$ 

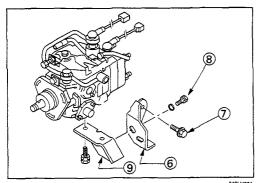




# 24. Injection Pump

- 1) Install the O-ring ① to the injection pump flange ②.
- 2) Install the injection pump to the timing gear case.

Align the idler gear "B"  $\$  "V-V" mark with the injection pump timing gear  $\$  "V" mark.



- 3) Install the injection pump rear bracket (6) and the rear bracket bolts (7) to the cylinder body.
- 4) Install the rear bracket bolts ® to the injection pump bracket ⑨.

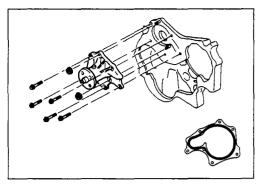


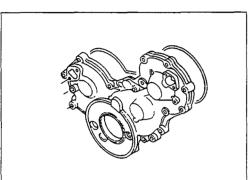
5) Tighten the injection pump bracket bolts to the specified torque.

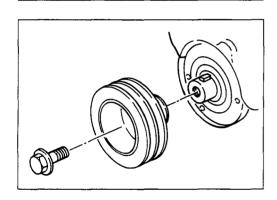
Injection Pump Bracket Bolt Torque

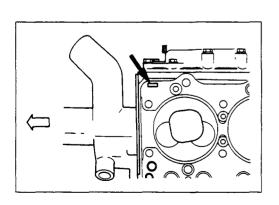
 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 









# 25. Water Pump

1) Apply the recommended liquid gasket or its equivalent to the water pump at the position shown in the illustration.

Do not apply an excessive amount of liquid gasket.

2) Tighten the water pump bolts to the specified torque.

Water Pump Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $2.0 \pm 0.5 (14.5 \pm 3.6/19.6 \pm 4.9)$ 



# 26. Timing Gear Case Cover

- 1) Align the gear case with the timing gear case knock pin and then install the timing gear case cover.
- Tighten the gear case cover bolts to the specified torque.

Gear Case cover Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 



# 29. Crankshaft Damper Pulley

Tighten the crankshaft damper pulley bolt to the specified torque.

#### Note:

Hold the flywheel ring gear stationary to prevent the crankshaft from turning when tightening the damper pulley.

Crankshaft Damper Pulley Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $21.0 \pm 2.0 (151.9 \pm 14.5/206.0 \pm 19.6)$ 

Take care not to damage the crankshaft damper pulley boss.

30. Cylinder Head Gasket



The cylinder head gasket "TOP" mark must be facing up.



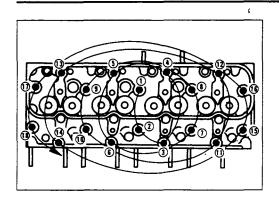
Before the gasket installation, measure the piston head projection and select the appropriate head gas-

Refer to "INSPECTION AND REPAIR", "Cylinder Head Gasket Selection".



# 31. Cylinder Head

- 1) Align the cylinder body dowels and the cylinder head dowel holes.
  - Carefully place the cylinder head on the cylinder head gasket.
- 2) Apply a coat of engine oil to the cylinder head bolt threads and setting faces





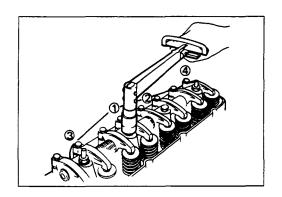
3) Tighten the cylinder head bolts in two steps (4JA1) or three steps (4JB1T, 4JA1T).

Follow the numerical sequence shown in the illustration.

Angle gauge: 5-8840-0266-0

Cylinde	/linder Head Bolt Torque kg⋅m(lb.t		·m(lb.ft/N·m)
	1st Step	2nd Step	3rd Step
4JB1T	5.0 ± 0.5 (36.2 ± 3.6/49.00 ± 4.90)	60°~75°	60°~75°

Cylinder Head Bolt Torque		Bolt Torque	kg·m(lb.ft/N·m
•		1st Step	2nd Step
4JA1	New bolt	5.0±0.5 (36.2±3.6/83.3±4.9)	8.7±0.5 (62.9±3.6/85.3±4.9)
	Reuse bolt	8.5±0.5 (61.4±3.6/83.3±4.9)	10.5±0.5 (75.9±3.6/102.9±4.9)

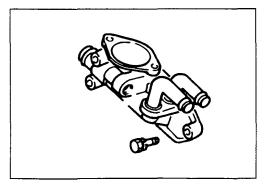




# 33. Rocker Arm Shaft and Rocker Arm

Tighten the rocker arm shaft bracket bolts in the numerical order shown in the illustration.

Rocker Arm Shaft Bracket Bolt Torque	kg·m(lb.ft/N·m)
$5.5 \pm 0.5$ (39.8 $\pm$ 3.6/54.0 $\pm$	4.9)

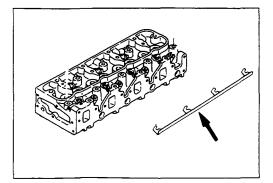




# 34. Thermostat Housing

- 1) Install the thermostat housing.
- 2) Tighten the thermostat housing bolts to the specified torque.

Thermostat Housing Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ±	± 4.9)



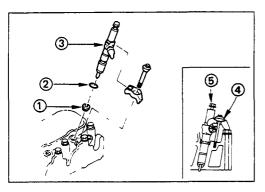


# 36. Glow Plug and Glow Plug Connector

- 1) Install the glow plugs to the cylinder head.
- 2) Tighten the glow plugs to the specified torque.

Glow Plug Torque	kg·m(lb.ft/N·m)
$2.25 \pm 0.25 (16.3 \pm 1.8/22.4)$	1 ± 2.5)

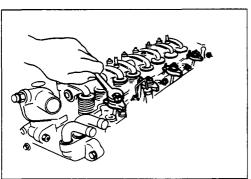
3) Install the glow plug connector.





#### 37. Injection Nozzle Holder

- 1) Install the injection nozzle gasket ① and the O-ring 2 to the injection nozzle holder 3. Be sure that the O-ring fits snugly in the injection nozzle groove.
- 2) Install the nozzle holder toghther with the nozzle holder bracket 4 to the cylinder head.





Nozzle Holder Bracket Bolt Torque  $kg \cdot m(lb.ft/N \cdot m)$ 

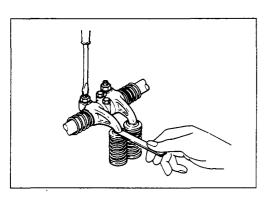
 $3.8 \pm 0.6 (27.5 \pm 4.3/37.2 \pm 5.9)$ 

3) Tighten the holder nut with washer 5 to the specified torque.

Injection Nozzle Holder Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $3.8 \pm 0.6 (26.0 \pm 4.3/37.2 \pm 5.9)$ 

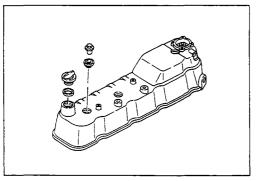




# **Note on Valve Clearance Adjustment**

Valve clearances must be adjusted before the cylinder head cover is reinstalled.

Refer to "Valve Clearance Adjustment" in the "Servicing" Section of this Manual.









# 38. Cylinder Head Cover

- 1) Apply engine oil to the rocker arm and the valve spring.
- 2) Install the cylinder head cover gasket to the head
  - Check to see that the head cover gasket has no loose areas.
- 3) Tighten the cylinder head cover nuts to the specified torque.

Cylinder Head Cover Bolt Torque

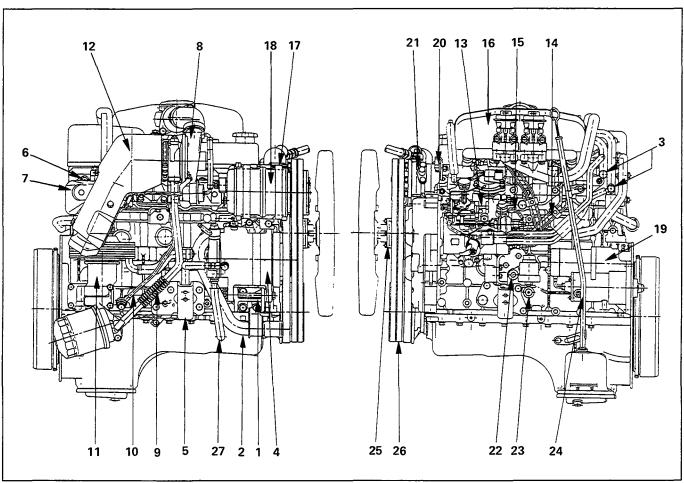
 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.3 \pm 0.5 (9.4 \pm 3.6/12.7 \pm 4.9)$ 

4) Connect the PCV hose to the cylinder head cover.

# → INSTALLATION EXTERNAL PARTS

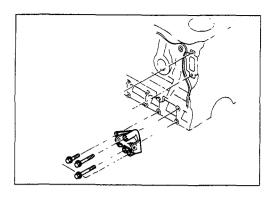
These installation steps are based on the 4JB1T engine



# **Installation Steps**

- ▲ 1. Alternator bracket
- ▲ 2. Water inlet pipe
- ▲ 3. Heater pipe (Rear side)
- ▲ 4. Alternator and adjusting plate
- ▲ 5. Engine mounting bracket
- ▲ 6. Exhaust manifold
  - 7. Exhaust manifold heat protector
- 8. Turbocharger
- ▲ 9. Turbocharger oil return pipe
- ▲ 10. Turbocharger oil feed pipe
- ▲ 11. Oil cooler with Oil filter
  - 12. Turbocharger heat protector
  - 13. Injection pump
- ▲ 14. Fuel injection pipe with clip
  - 15. Fuel leak off pipe

- ▲ 16. Intake manifold
- ▲ 17. Compressor bracket
- ▲ 18. Compressor
- ▲ 19. Starter motor
- ▲ 20. Power steering oil pump bracket
- ▲ 21. Power steering oil pump
  - 22. Water drain cock
  - Oil pressure warning switch and nipple
  - 24. Oil level gauge guide tube
  - 25. Cooling fan pulley
  - 26. Cooling fan drive belt
  - 27. Vacuum pipe





# **Important Operations**



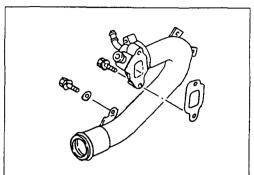
#### 1. Alternator Bracket

Install the alternator bracket to the cylinder body and tighten the bracket bolts to the specified torque.

**Bracket Bolt Torque** 

kg·m(lb.ft/N·m)

 $4.1 \pm 0.6 (29.7 \pm 4.3 / 40.2 \pm 5.9)$ 





# 2. Water Inlet Pipe

1) Tighten the water inlet pipe bolts to the specified torque.

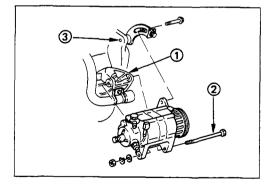
Suction Pipe Bolt Torque

kg·m(lb.ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6 / 18.6 \pm 4.9)$ 

# 3. Heater Pipe (Rear Side)

- 1) Install the heater pipe to the cylinder head.
- 2) Connect the oil cooler return hose and feed hose to the oil cooler.
- 3) Connect the water rubber hose to the heater pipe.

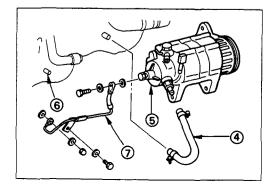




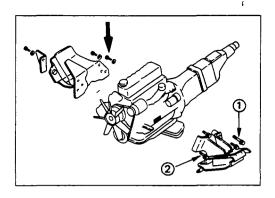
# 4. Alternator and Adjusting Plate

- 1) Install the alternator to the bracket (1).
- 2) Temporarily tighten the alternator bolt ② and adjusting plate bolts ③.

The bolts will be finally tightened after installation of the cooling fan drive belt.



- 3) Connect the vacuum pump rubber hose 4 to the vacuum pump 5, and the oil pan 6.
- 4) Connect the vacuum oil pipe ⑦ to the vacuum pump, and the cylinder body.

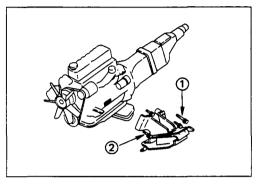




# 5. Engine Mounting Bracket

Install the engine mounting bracket to the cylinder body and tighten the bracket bolts to the specified torque.

Mounting Bracket Bolt Torque		kg·m(lb.ft/N·m)
Right Side	M10×1.25 (9T)	5.6 (40.5/54.9)
Left Side	② M10×1.25 (7T)	4.1 (30/40)
	② M14×1.50 (7T)	12 (86.7/118)

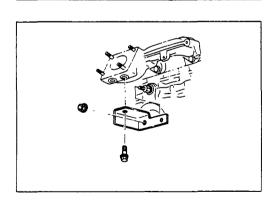




## 6. Exhaust Manifold

- Install the exhaust manifold ① to the cylinder head
   with the manifold gasket ③.
- 2) Tighten the exhaust manifold bolts to the specified torque a little at a time.

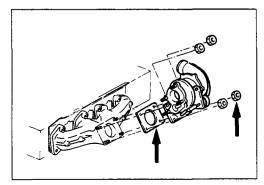
Exhaust Manifold Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ±	3.6/18.6 ± 4.9)





3) Install the exhaust manifold bracket to the manifold and the cylinder body.

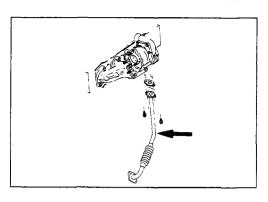
Manifold Bracket Bolt Torque	kg·m(lb.ft/N·m)
$1.9 \pm 0.5 \ (13.7 \pm 3.6/18.6 \pm 4.9)$	



#### 8. Turbocharger

- 1) Install the turbocharger and the gasket.
- 2) Temporarily tighten the turbocharger nuts at this time. They will be fully tightened after the installation of the turbocharger oil pipe.

Always install new nuts and washers.

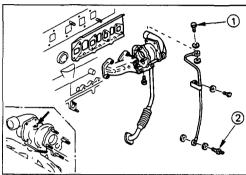




# 9. Turbocharger Oil Return Pipe

- 1) Install the oil return pipe with gasket to the turbocharger.
- 2) Tighten the turbocharger oil return pipe to the specified torque.

Turbocharger Oil Reutrn Pipe Torque kg·m(lb.ft/N·m)  $0.8 \pm 0.2 (5.8 \pm 1.4/7.8 \pm 2.0)$ 





# 10. Turbocharger Oil Feed Pipe

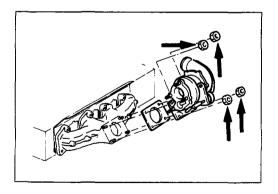
- 1) Before installing the oil feed pipe, supply 100 130 cm<sup>3</sup> (6 8 in<sup>3</sup>) of clean engine oil to the turbocharger center housing through the oil feed opening.
- 2) Turn the rotating assembly with your hand to throughly lubricate the internal parts.
- 3) Tighten the oil feed pipe to the specified torque.

 Turbocharger Oil Feed Pipe Joint

 Bolt Torque
 kg·m(lb.ft/N·m)

 ① M10 × 1.5
  $2.25 \pm 0.25$  (16.3  $\pm$  1.8/22.05  $\pm$  2.45)

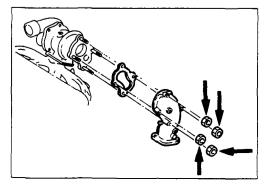
 ② M14 × 1.5
  $3.0 \pm 0.25$  (21.7  $\pm$  1.8/29.40  $\pm$  2.45)





4) Tighten the turbocharger nut to the specified torque.

Turbocharger Nut Torque kg·m(lb.ft/N·m)  $2.7 \pm 0.5 (19.5 \pm 3.6/26.5 \pm 4.9)$ 



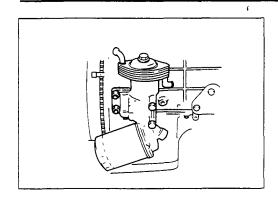


# **Exhaust Adapter**

Install the exhaust adapter with gasket and tighten the adapter bolts to the specified torque.

Adapter Bolt Torque kg·m(lb.ft/N·m)

 $2.7 \pm 0.5$  (19.5 ± 3.6/26.5 ± 4.9)



#### 11. Oil Cooler with Oil Filter

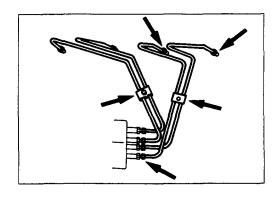
- 1) Install the O-ring to the oil filter flange groove.
- 2) Tighten the oil filter and oil cooler to the specified torque.

Oil Filter Flange Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6 / 18.6 \pm 4.9)$ 

- 3) Lightly oil the O-ring of oil filter cartridge.
- 4) Turn in the new oil filter cartridge by hand until the sealing face is fitted again the O-ring.
- 5) Use the filter wrench to turn in the oil filter and additional one and 1-1/8 turns.
- 6) Start the engine and check for oil leakage from oil filter.





# 14. Fuel Injection Pipe with Clip

- 1) Temporarily tighten the injection pipe sleeve nut.
- 2) Set the clip in the illustrated position.

#### Note:

Make absolutely sure that the clip is correctly positioned.

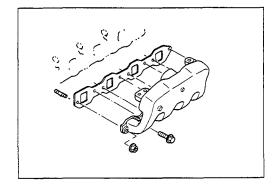
An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

3) Tighten the injection pipe sleeve nut to the specified torque.

Injection Pipe Sleeve Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

$$3 \pm 1 (21.7 \pm 7.2 / 29.4 \pm 9.8)$$



#### 16. Intake Manifold

- 1) Install the manifold gasket to the intake manifold.
- 2) Connect the intake rubber hose to the intake duct.
- 3) Tighten the intake manifold bolts and the flange nuts to the specified torque.

Intake Manifold Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

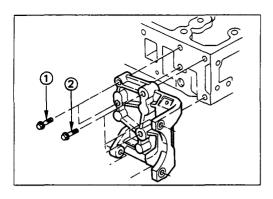
 $1.9 \pm 0.5 (13.7 \pm 3.6 / 18.6 \pm 4.9)$ 

Intake Manifold Flange Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $2.4 \pm 0.5 (17.3 \pm 3.6 / 23.5 \pm 4.9)$ 

4) Connect the PCV hose to the cylinder head cover.

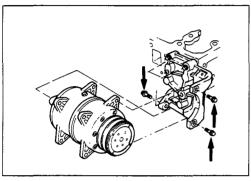




# 17. Compressor Bracket

- 1) Install the compressor bracket to the cylinder head.
- 2) Tighten the bracket bolts to the specified torque.

Bracket Bolt Torque	kg·m(lb.ft/N·m)
① M 8 X 1.25	$1.9 \pm 0.5 (13.7 \pm 3.6 / 18.6 \pm 4.9)$
② M10 X 1.25	$3.8 \pm 1.0 (27.5 \pm 7.2 / 37.2 \pm 9.8)$





#### 18. Compressor

- 1) Install the compressor to the compressor bracket.
- 2) Tighten the compressor bolts to the specified torque.

Compressor Bolt Torque	kg·m(lb.ft/N·m)

 $3.8 \pm 1.0 (27.5 \pm 7.2 / 37.2 \pm 9.8)$ 



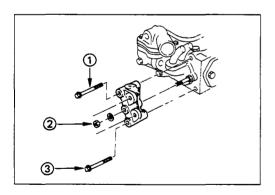
# 19. Starter Motor

Tighten the starter motor bolts to the specified torque.

Starter Motor Bolt Torque

kg·m(lb.ft/N·m)

 $7.0 \pm 1.0 (50.6 \pm 7.2 / 68.6 \pm 9.8)$ 





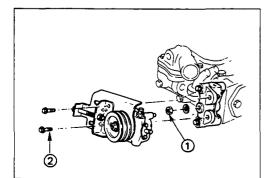
# 20. Power Steering Oil Pump Bracket

## 21. Power Steering Oil Pump

- 1) Install the oil pump bracket to the cylinder head.
- 2) Tighten the pump bracket nut and bolts to the specified torque.

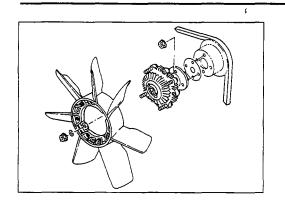
Oil Pump Bracket Nut and Bolt Torque

Torque	kg·m(lb.ft/N·m)
① M10 X 1.25 (7T)	3.75 ± 0.95 (27.1 ± 6.9 / 36.75 ± 9.31)
② M 8 X 1.25 (7T)	1.75 ± 0.55 (12.7 ± 4.0 / 17.75 ± 5.39)
③ M 8 X 1.25 (4T)	1.30 ± 0.50 (9.4 ± 3.6 / 12.74 ± 4.90)





- 3) Install the oil pump to the bracket.
- 4) Temporarily tighten the oil pump nut ① and bolts ②. The nut and bolts will be finally tightened after installation of the drive belt.





# 25. Cooling Fan Pulley

- Install the cooling fan pulley to the water pump with spacer.
- 2) Tighten the cooling fan pulley bolts to the specified torque.

Cooling Fan Pulley Bolt Torque kg·m(lb.ft/N·m)  $0.8 \pm 0.2 (5.8 \pm 1.4 / 7.8 \pm 2.0)$ 

# 26. Cooling Fan Drive Belt

Install the fan drive belt and adjust the belt tension referring **SERVICING** of this section.

# **LUBRICATING SYSTEM**

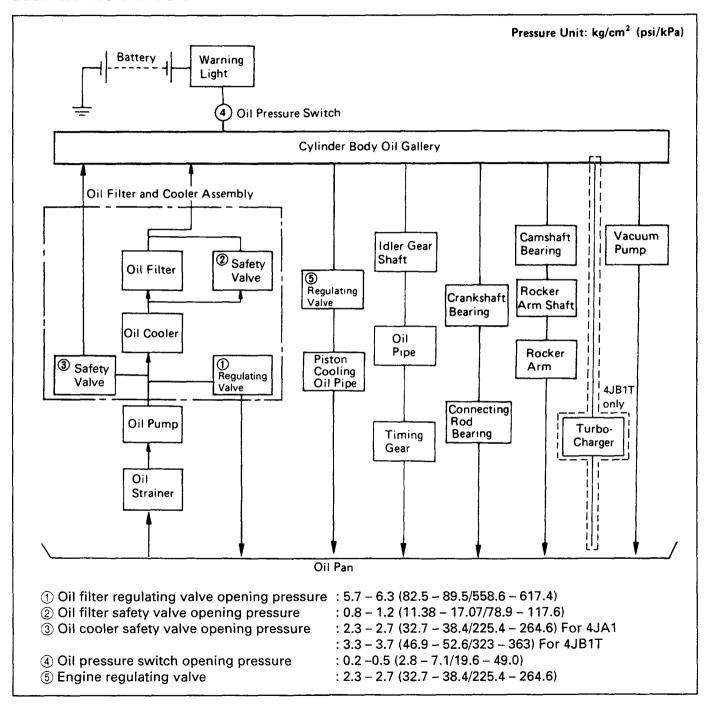
# MAIN DATA AND SPECIFICATIONS

Engine model		4JA1	4JB1T
Oil pump type		Ge	ear
Oil pressure switch operating pre	ssure kg/cm²(psi/kPa)	0.2 — 0.5 (2.8 —	7.1/19.6 — 49.0)
Oil filter type		Full flow with cartri	idge paper element
Relief valve opening pressure	kg/cm²(psi/kPa)	4.3 — 4.7 (61.1 — 66.8/ 421.4 — 460.6)	5.7 — 6.3 (82.5 — 89.5/ 558.6 — 617.4)
Safety valve opening pressure Oil cooler type	kg/cm²(psi/kPa)	0.8 — 1.2 (11.38 — Water-	·
Safety valve opening pressure	kg/cm²(psi/kPa)	2.3 - 2.7 (32.7 - 3	88.4/225.4 — 264.6)

4JB1T: 4JB1 Engine with turbocharger.

# **GENERAL DESCRIPTION**

## LUBRICATING OIL FLOW

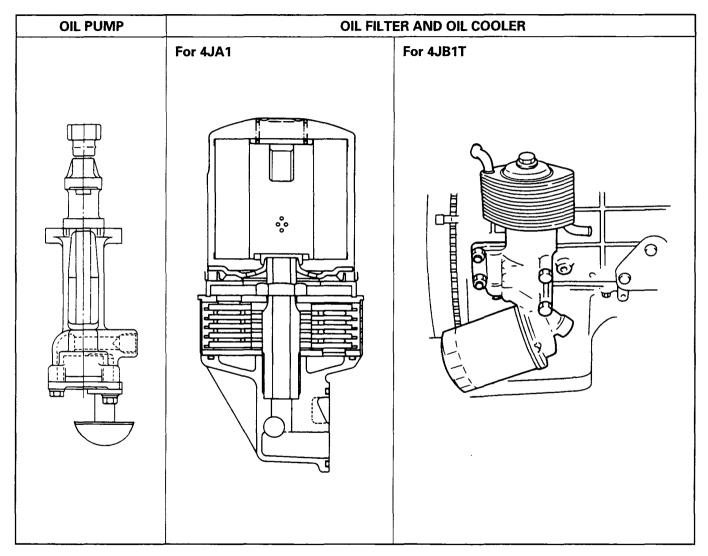


The 4J series engine has a full flow type lubricating system.

Lubricating oil is pumped from the oil pump to the cylinder body oil gallery through the oil cooler and the oil filter. It is then delivered to the vital parts of the engine from the cylinder body oil gallery.

Oiling jets installed on the cylinder body spray engine oil to the piston backside faces to achieve maximum piston cooling effect.

# **OIL PUMP AND OIL FILTER**



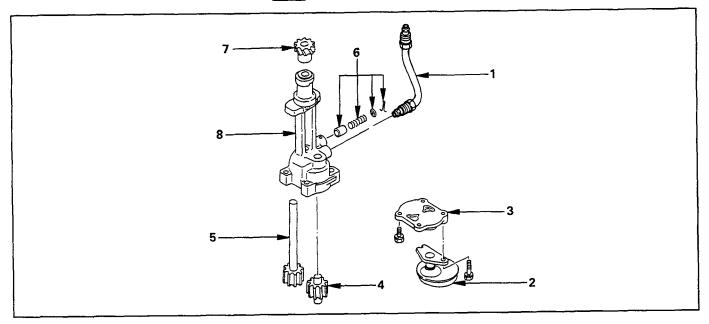
The 4J series engine is equipped with a gear type oil pump.

The oil filter and the water cooled oil cooler integrated a single unit to increase the cooling effect.

# **OIL PUMP**



# **DISASSEMBLY**



# **Disassembly Steps**

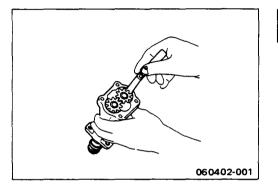
- 1. Oil pipe
- 2. Strainer
- 3. Pump cover
- 4. Driven gear with bush
- 5. Driven gear

- 6. Relief valve asm.
- 7. Pinion gear
- B. Oil pump body



# INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





# Gear Teeth and Body Inner Wall Clearance

Use a feeler gauge to measure the clearance between the gear teeth and the body inner wall.

If the clearance between the gear teeth and the body inner wall exceeds the specified limit, either the gear or the body must be replaced.

Gear Teeth and Body Inner Wall Clearance		<u>mm(in)</u>
Standard	Limit	
0.14 (0.0055)	0.20 (0.0079)	

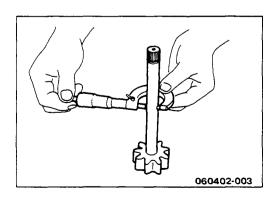


# **Gear and Body Clearance**

Use a feeler gauge to measure the clearance between the body and the gear.

If the clearance between the gear and the body exceeds the specified limit, the body must be replaced.

Limit
0.15 (0.0059)





060402-002

# **Drive Shaft and Oil Pump Body Clearance**

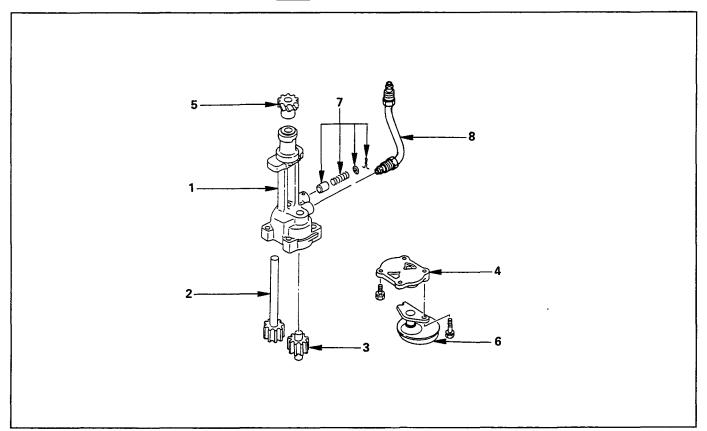
Use a micrometer to measure the drive shaft outside diameter.

Use an inside dial indicator to measure the pump body inside diameter.

If the clearance between the drive shaft and the oil pump body exceeds the specified limit, the oil pump assembly must be replaced.

Drive Shaft and Oil Pump Body Clearance mm	
Standard	Limit
0.04 (0.0016)	0.20 (0.0079)





# **Reassembly Steps**

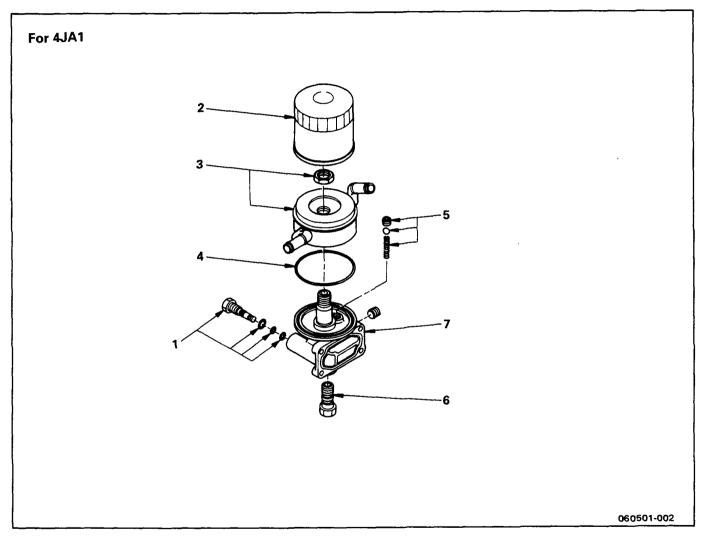
- 1. Oil pump body
- 2. Drive gear
- 3. Driven gear
- 4. Pump cover

- 5. Pinion gear
- 6. Strainer
- 7. Relief valve asm.
- 8. Oil pipe

# **OIL FILTER AND OIL COOLER**



# **DISASSEMBLY**

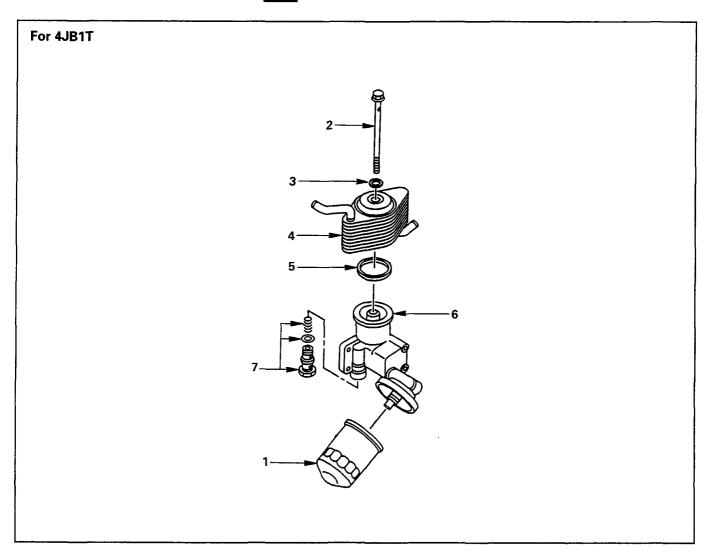


# **Disassembly Steps**

- Drain plug
   Cartridge oil filter
- 3. Oil cooler
- 4. O-ring

- 5. Safety valve
- 6. Relief valve
- 7. Oil filter body

# DISASSEMBLY



## **Disassembly Steps**

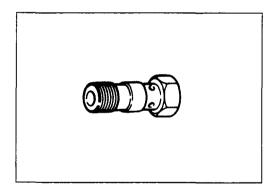
- 1. Oil filter cartridge
- 2. Bolt
- 3. Gasket
- 4. Oil cooler

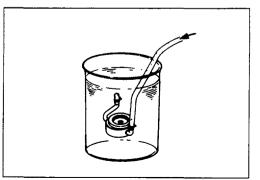
- 5. Gasket
- 6. Body
- 7. Relief valve



## **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





#### **Relief Valve**

- Attach an oil pressure gauge to the oil gallery near the oil filter.
- 2. Start the engine to check the relief valve opening pressure.

· · · · · · · · · · · · · · · · · · ·
66.8/421.4—460.6)
39.5/558.6—617.4)

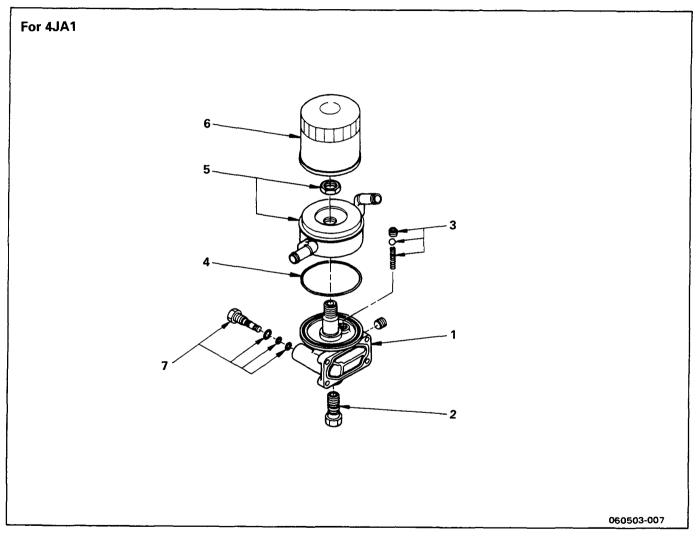
## Oil Cooler

age.

Water Leakage at Water Passage

- 1. Plug one side of the oil cooler water passage.
- 2. Submerge the oil cooler in water.
- Apply compressed air (2 kg/cm² (28 psi/200 kPa)) to the other side of the oil cooler water passage.
   If air bubbles rise to the surface, there is water leak-

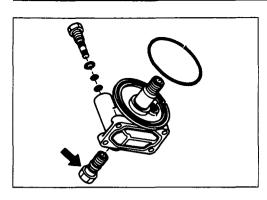




## **Reassembly Steps**

- 1. Oil filter body
- ▲ 2. Relief valve
  - 3. Safety valve
  - 4. O-ring

- ▲ 5. Oil cooler
- ▲ 6. Oil filter cartridge
- ▲ 7. Drain plug



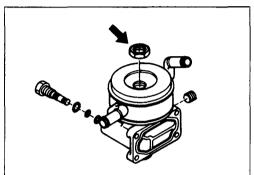


## **Important Operations**

# 2. Relief Valve

Tighten the relief valve to the specified torque.

Relief Valve Torque	kg·m(lb.ft/N·m
3.0 + 0.5 (21.7	+ 3.6/29.4 + 4.9)

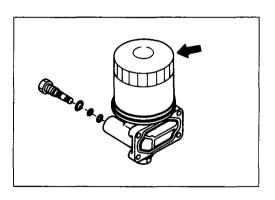




## 5. Oil Cooler

- 1) Align the oil filter holes with the body knock pins at installation.
- 2) Tighten the oil cooler nut to the specified torque

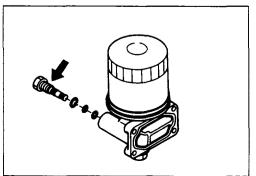
2)	righten the oil cooler nut	to the specified torque.
Oil C	Cooler Nut Torque	kg·m(lb.ft/N·)
	$3.0 \pm 0.5$ (21.7 $\pm$	3.6/29.4 ± 4.9)





## 6. Oil Filter Cartridge

- 1) Apply engine oil to the O-ring.
- 2) Turn in the cartridge oil filter until the filter sealing face makes contact with the O-ring.
- 3) Turn in the cartridge oil filter an additional one and 1/8 of a turn.



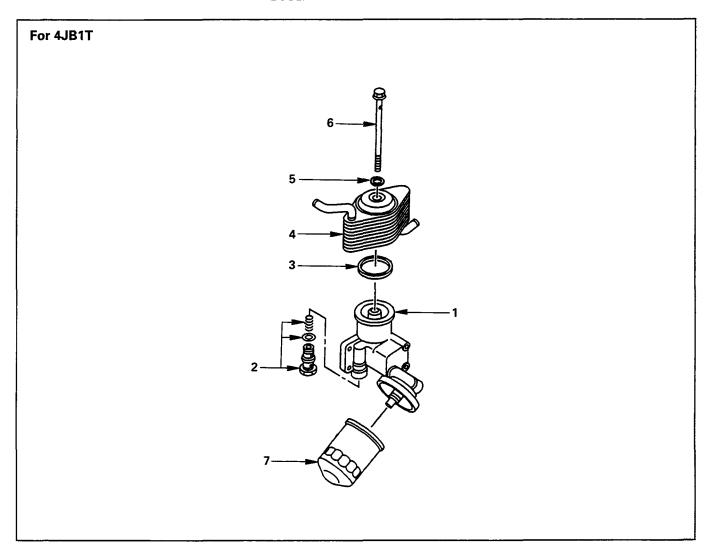


## 7. Drain Plug

Tighten the drain plug to the specified torque.

Drain Plug Torque	ue kg·m(lb.ft/N	
2.5 + 0	15 (18.1 + 3.6/24.5 + 4.9)	



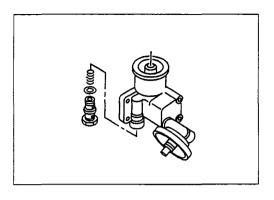


# **Reassembly Steps**

- 1. Body
- ▲2. Relief valve
  - 3. Gasket
- ▲4. Oil cooler

- 5. Gasket
- ▲6. Bolt
- ▲7. Oil filter cartridge

#### **6A-134 ENGINE MECHANICAL**

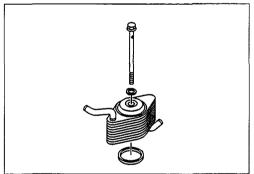




#### 2. Relief Valve

Tighten the safety valve to the specified torque.

Safety Valve	Torque		k	g·m(lb.ft/N·m)
	$0.3 \pm 0.05$	5(4.3 + 0.7/2)	94+49	1)



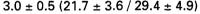


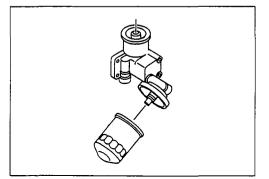
## 4. Oil Cooler

## 6. Bolt

Tighten Bolt with gaskets and oil cooler to the specified torque.

<b>Bolt Torque</b>		kg·m(lb.ft/N·m)
	 0 = 101 = 0 0 100 1	4.01







## 7. Oil Filter Cartridge

1) Apply engine oil to the O-ring.



2) Tighten the oil filter cartridge to the specified torque.



 $0.2 \pm 0.02 (2.8 \pm 0.28 / 19.6 \pm 2.0)$ 







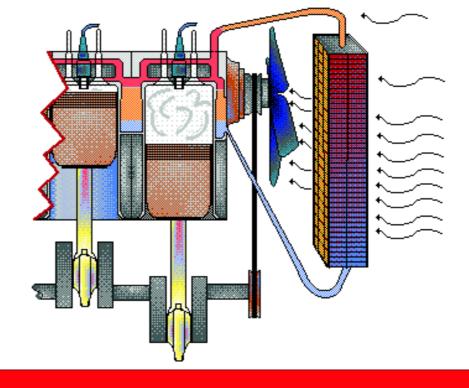




Water Pump

**Thermostat** 

Fan



# KB TF 140 Cooling System

# SECTION 6B ENGINE COOLING

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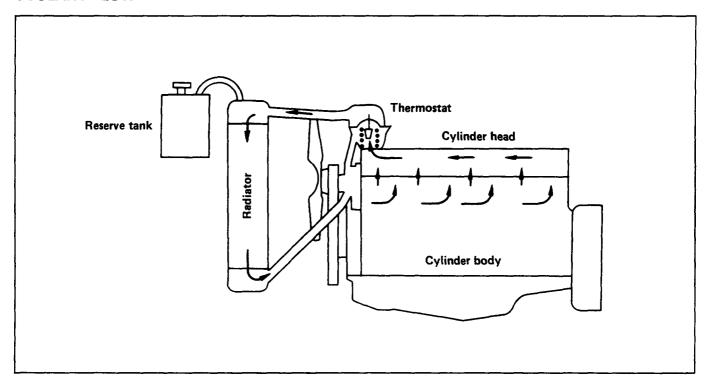
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Inspection and Repair	6B—13

# MAIN DATA AND SPECIFICATIONS

Item	Description
Water pump type	Centrifugal
Pump to crankshaft speed ratio (To 1)	1.1
Delivery volume lit (US/UK gal)/min Pump speed at 3000 rpm Water temperature at 30°C (86°F)	100 (26.3/22.2)
Pump bearing type	Double row shaft
Thermostat type	Wax pellet with jiggle valve
Valve initial opening temperature °C(°F)	82 (180)
Valve full opening temperature °C(°F)	95 (203)
Valve lift at fully open position mm(in)	9.5 (0.37)

## **GENERAL DESCRIPTION**

## **COOLANT FLOW**



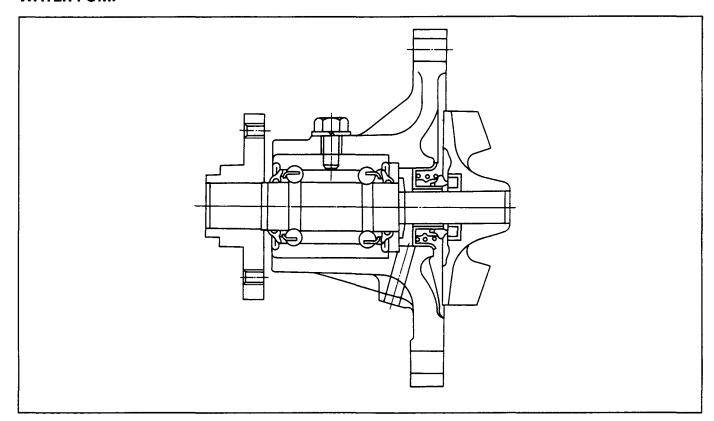
The engine cooling system consists of the radiator, the water pump, the cooling fan, and the thermostat.

To quickly increase cold engine coolant temperature for smooth engine operation, the coolant is circulated by the water pump and thermostat through the bypass hose and back to the cylinder body. The coolant does not circulate through the radiator.

When the coolant temperature reaches specified value, the thermostat will begin to open and a gradually increasing amount of coolant will circulate through the radiator.

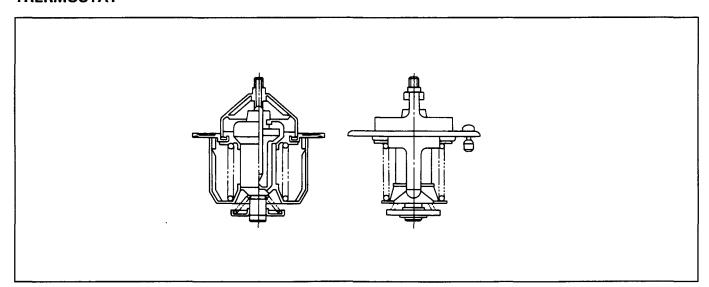
The thermostat will be fully open when the coolant temperature reaches specified value. All of the coolant is now circulating through the radiator for effective engine cooling.

## **WATER PUMP**



A centrifugal type water pump forcefully circulates the coolant through the cooling system.

## **THERMOSTAT**



A wax pellet type thermostat is used.

The jiggle valve accelerates engine warm-up.

# **WATER PUMP**



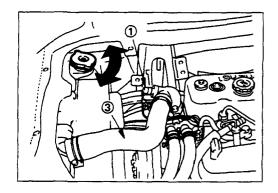


# **←→** REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

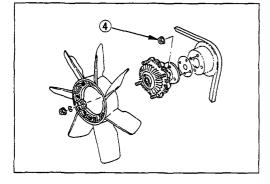


Important Operations - Removal



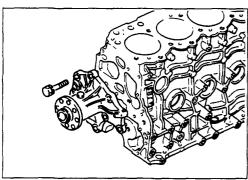
## **Radiator Upper Hose**

- 1. Disconnect the wiring harness (1).
- 2. Partially drain the engine coolant.
- 3. Remove the radiator upper hose 3.



### Fan and Fan Clutch

- 1. Loosen the fan clutch nuts 4.
- 2. Remove the fan together with the fan clutch. Take care not to damage the radiator core.



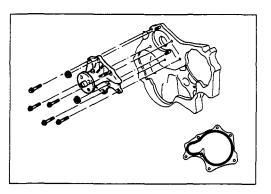
#### Water Pump

- 1. Remove the water pump bolts.
- 2. Remove the water pump.



## Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





## **Water Pump**

1) Apply the recommended liquid gasket or its equivalent to the water pump at the position shown in the illustration.

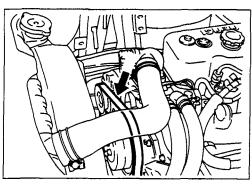
Do not apply an excessive amount of liquid gasket.

2) Tighten the water pump bolts to the specified torque.

Water Pump Bolt Torque

 $kg \cdot m(lb \cdot ft/N \cdot m)$ 

 $2.0 \pm 0.5 (14.5 \pm 3.6/19.6 \pm 4.9)$ 





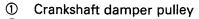
## **Cooling Fan Drive Belt**

- Install the cooling fan drive belt.
- 2. Apply tension to the cooling fan drive belt by moving the alternator.
- 3. Apply a force of 10 kg (22 lb/98 N) to the drive belt mid-portion to check the drive belt deflection.

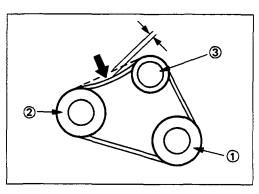
Cooling Fan Drive Belt Deflection

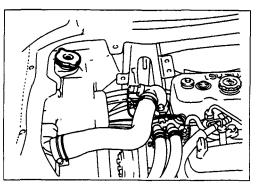
mm(in)

10 (0.4)



- Alternator pulley
- Cooling fan drive pulley
- 4. Tighten the remaining water pump bolt to the specified torque.







## **Radiator Upper Hose**

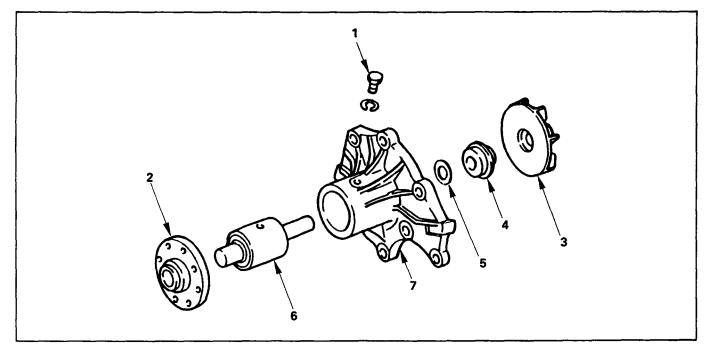
## **Heater Hose**

- 1. Connect the radiator upper hose to the water outlet pipe.
- 2. Replenish the engine coolant.
- 3. Make sure the wiring harness is properly connected.
- 4. Start the engine and allow it to warm up.
- Check the temperature gauge operation.





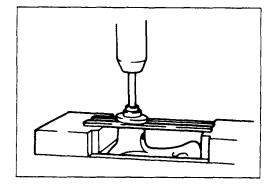
# DISASSEMBLY



## **Disassembly Steps**

- 1. Set screw
- ▲ 2. Cooling fan center
- ▲ 3. Impeller
- ▲ 4. Seal unit

- 5. Thrower
- ▲ 6. Bearing unit
  - 7. Water pump body

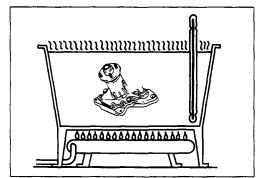




## **Important Operations**

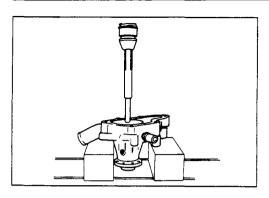
## 2. Cooling Fan Center

Remove the fan center with a bench press and a bar.



- 3. Impeller
- 4. Seal Unit
- 6. Bearing Unit
  - 1) Heat the pump body in hot water (80 90°C/176 194°F).

### **6B-8 ENGINE COOLING**



Remove the impeller, the seal unit, and the bearing unit, and the bearing unit with a bench press and a bar.

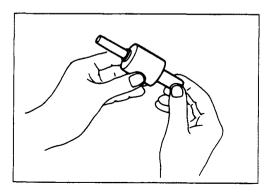
#### Note:

Do not drive out the impeller with a hammer. Damage to the impeller will result.



# INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



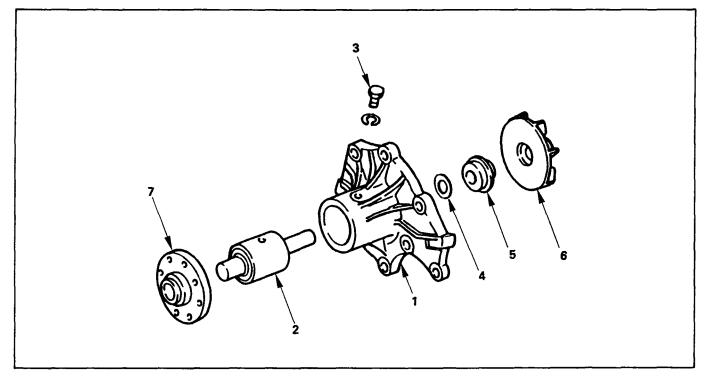


## **Bearing Unit**

Check the bearing for abnormal noise, binding, and other abnormal conditions.



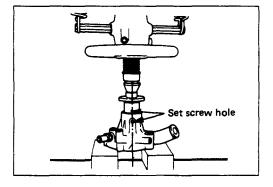
# REASSEMBLY



## Reassembly Steps

- 1. Water pump body
- ▲ 2. Bearing unit
- ▲ 3. Set screw
  - 4. Thrower

- ▲ 5. Seal unit
- ▲ 6. Impeller
- ▲ 7. Cooling fan center



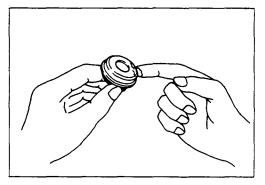


## **Important Operations**



## 2. Bearing Unit

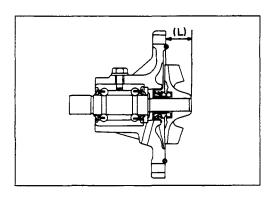
- 3. Set Screw
- 1) Align the bearing set screw hole with the pump body set screw hole.
- 2) Press the bearing unit into place.
- 3) Secure the bearing with the set screw.





## 5. Seal Unit

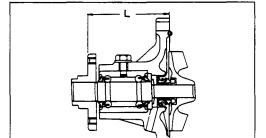
- 6. Impeller
- 1) Apply a thin coat of liquid gasket to the seal unit outer periphery.
- 2) Install the seal unit.





3) Use a bench press to slowly force the impeller into place until the impeller installed distance from the water pump body face is equal to the specified value.

Impeller Projection (L) (Reference) mm(in)
25 (0.98)



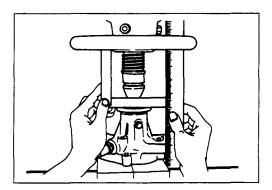


## 7. Cooling Fan Center

Measure the distance between the cooling fan fitting face and the rear cover fitting face.

Cooling Fan Center Distance 

79.2—79.8 (3.12—3.14)



### Notes:

1. The fan center and the impeller are installed to the water pump shaft with a press.

Never attempt to remove and reinstall the fan center and the impeller a second time. Replace the entire water pump assembly.

Removing and reinstalling the fan center and the impeller a second time may result in the breakdown of the water pump during engine operation and subsequent serious overheating problems.

- 2. The water pump assembly must be replaced whenever the fan center and impeller pressure force falls below 200 kg. (440 lb/1,960 N)
- 3. Do not attempt to strike the bearing into position with a hammer or similar object. Damage to the bearing will result.

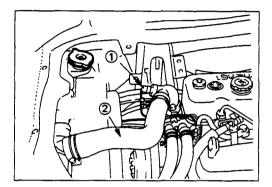
# **THERMOSTAT**





# | →+ | REMOVAL AND INSTALLATION

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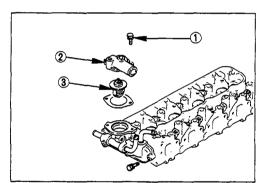




## Important Operations - Removal

## **Radiator Upper Hose**

- 1. Disconnect the wiring harness (1).
- 2. Partially drain the engine coolant.
- 3. Disconnect the radiator upper hose 2.



## **Water Outlet Pipe**

#### **Thermostat**

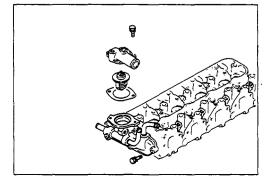
- 1. Loosen the water outlet pipe bolt 1.
- 2. Remove the water outlet pipe (2).
- 3. Remove the thermostat 3 from the thermostat housing.

Take care not to damage the thermostat.



## Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





### **Thermostat**

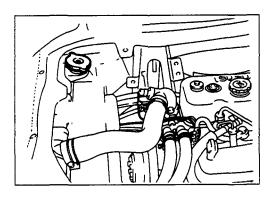
## Water Outlet Pipe

- 1. Install the thermostat to the thermostat housing.
- 2. Install the water outlet pipe with the gasket to the thermostat housing.
- 3. Tighten the outlet pipe to the specified torque.

Outlet Pipe Bolt Torque

kg·m(lb·ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 





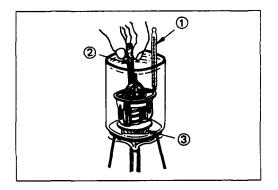
## **Radiator Upper Hose**

- 1. Connect the radiator upper hose to the water outlet pipe.
- 2. Replenish the engine coolant.
- 3. Make sure the wiring harness is properly connected.
- 4. Start the engine and allow it to warm up.
- 5. Check the temperature gauge operation.



# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





## **Operating Test**

- 1. Completely submerge the thermostat in water.
- 2. Heat the water. Stir the water constantly to avoid direct heat being applied to the thermostat.
- 3. Check the thermostat initial opening temperature.

°C(°F) Thermostat Initial Opening Temperature 82 (180) 4. Check the thermostat full opening temperature. °C(°F)

Thermostat Full Opening Temperature

95 (203)

Valve Lift At Fully Open Position mm(in)

9.5 (0.37)

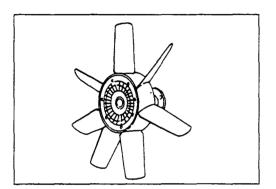
- 1 Thermometer
- ② Agitating rod
- ③ Wooden piece

# **FAN CLUTCH WITH COOLING FAN**



# **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage or any other abnormal condition are found through inspection.



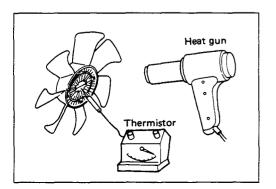


Visually inspect for damage, leak (sillicon grease) or other abnormal conditions.

## 1. Inspection (on-vehicle)

- Turn the fan clutch by hand when in a low temperature condition before starting the engine, and confirm that it can be turned readily.
- 2) Start the engine to warm it up until the temperature at the fan clutch portion gets to around 80°C. Then stop the engine and confirm that the fan clutch can be turned with considerable effort (clutch torque) when turned by hand.

If the fan clutch rotates more readily, however, this indicates that the silicone grease is leaking internally. Replace the fan clutch with a new one.



## 2. Inspection (in unit)

Warm up the bimetal of the fan clutch by using the heat gun until the temperature gets to about 80°C when measured with the thermistor. Then confirm that the fan clutch can be turned with considerable effort (clutch torque).

If the fan clutch retates more readily at this time, this indicates that the silicone grease is leaking internally. Replace the fan clutch with a new one.



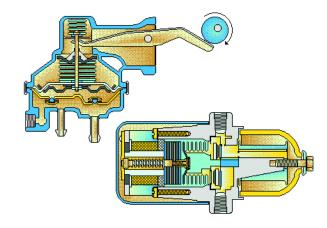


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Pump

Nozzle

Calibration



# KB TF 140 Diesel Fuel System

# **SECTION 6C**

# **FUEL SYSTEM**

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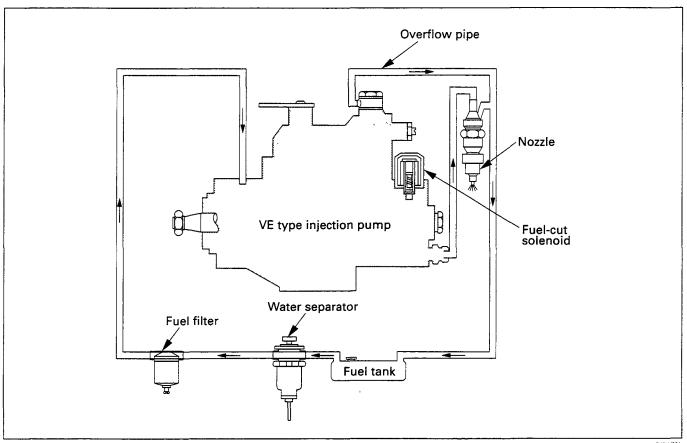
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# MAIN DATA AND SPECIFICATIONS

ltem		Description	
		4JA1	4JB1T
Injection pump type		Bosch Di	stributor
Plunger outside diameter	mm(in)	11 (0.43)	
Plunger prestroke	mm(in)	0.45 (0.0177)	
Governor type		Mechanical variable speed	Mechanical limit speed
Timer type		Oil pressure	
Fuel feed pump type		Vane with input shaft	
Injection nozzle type		Hole type	
Number of injection nozzl	e orifices	5	
Injection nozzle orifices inside diameter	mm(in)	0.21 (0.0083)	0.27 (0.0106)
Injection nozzle opening	kg/cm²(psi/kPa)	185 (2,631/18,130)	
Main fuel filter type		Disposable cartr water se	ridge paper element and eparator

# **GENERAL DESCRIPTION**

## **FUEL FLOW**



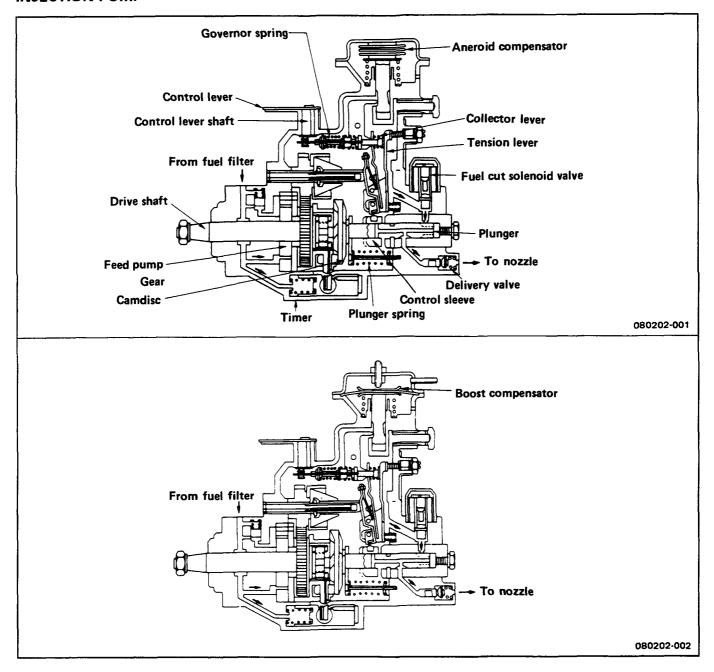
D40LV00

The fuel system consists of the fuel tank, the water separator, the fuel filter, the injection pump, and the injection nozzle.

The fuel from the fuel tank passes through the water separator and the fuel filter where water particles and other foreign material are removed from the fuel.

Fuel, fed by the injection pump plunger, is delivered to the injection nozzle in the measured volume at the optimum timing for efficient engine operation.

## **INJECTION PUMP**



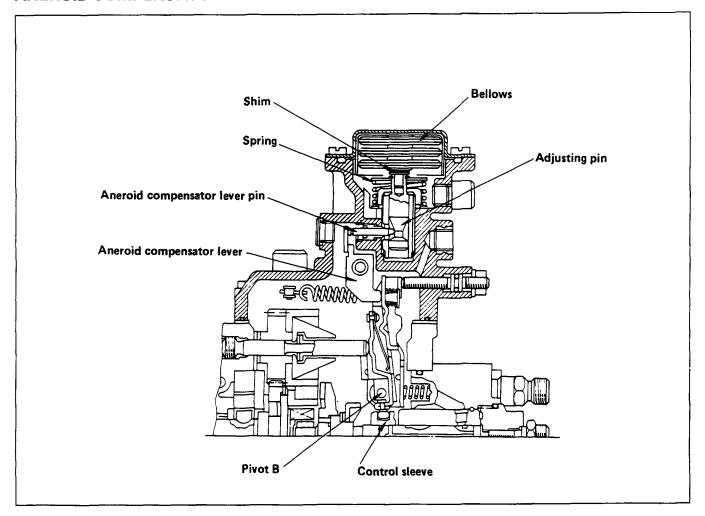
A Bosch Distributor Type Injection Pump is used. A single reciprocating/revolving plunger delivers the fuel uniformly to the injection nozzles, regardless of the number of cylinders.

The governor, the injection timer, and the feed pump are all contained in the injection pump housing. The injection pump is compact, light weight, and provides reliable high-speed operation.

An aneroid compensator is available as an option for vehicles to be operated at high altitudes. It adjusts the fuel and air mixing ratio.

A boost compensator is installed on turbocharger equipped vehicles.

## **ANEROID COMPENSATOR**



The aneroid compensator consists of the compensator housing, the bellows, the adjusting pin, the aneroid compensator lever pin, and the aneroid compensator lever.

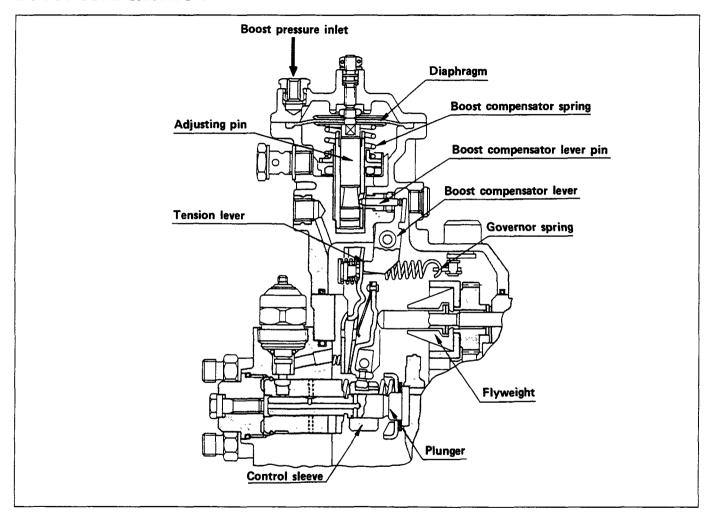
Atmospheric pressure decreases as altitude increases. The decreased atmospheric pressure causes the bellows to expand and push the adjusting pin down.

The adjusting pin pushes the aneroid compensator lever pin and the aneroid compensator lever to the left.

The aneroid compensator lever pushes the tension lever to the right.

The tension lever actuates the control sleeve to decrease the fuel flow.

## **BOOST COMPENSATOR**



The boost compensator consists of the compensator housing, the diaphragm, the adjusting pin, the boost compensator lever pin, and the boost compensator lever.

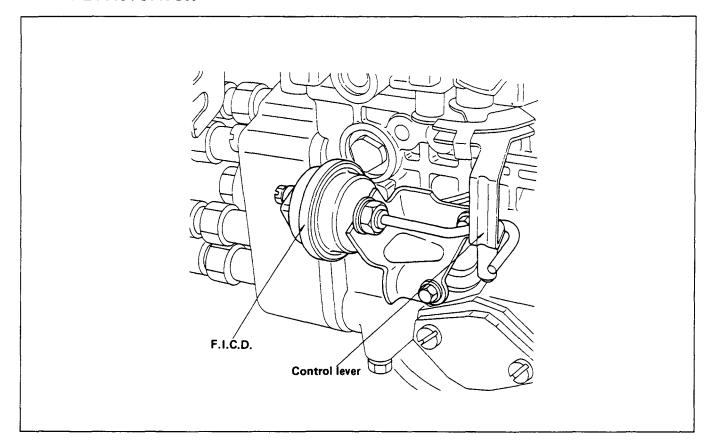
The increase boost pressure cause the diaphragm to lower and push the adjusting pin down.

The adjusting pin pushes the boost compensator lever pin and the boost compensator lever to the left.

The boost compensator lever pushes the tension lever to the right.

The tension lever actuates the control sleeve to increase the fuel flow.

## **FAST IDLE ACTUATOR**

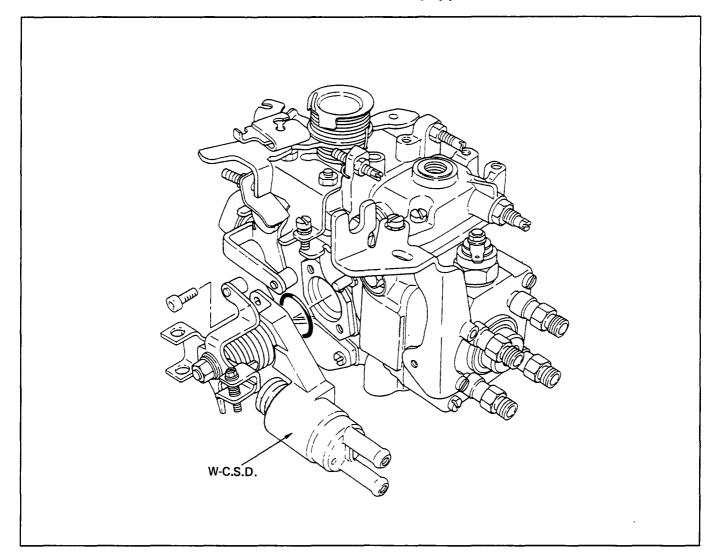


The vacuum-type fast idle actuator increases the engine idling speed to provide the additional power required to operate the air conditioner.

Fast idler diaphragm movement is caused by changes in the negative pressure created by the engine's vacuum pump.

The diaphragm motion is transferred to the injection pump control lever to increase or decrease the idling speed.

## WAX TYPE COLD START DEVICE (W - CSD) (If so equipped)



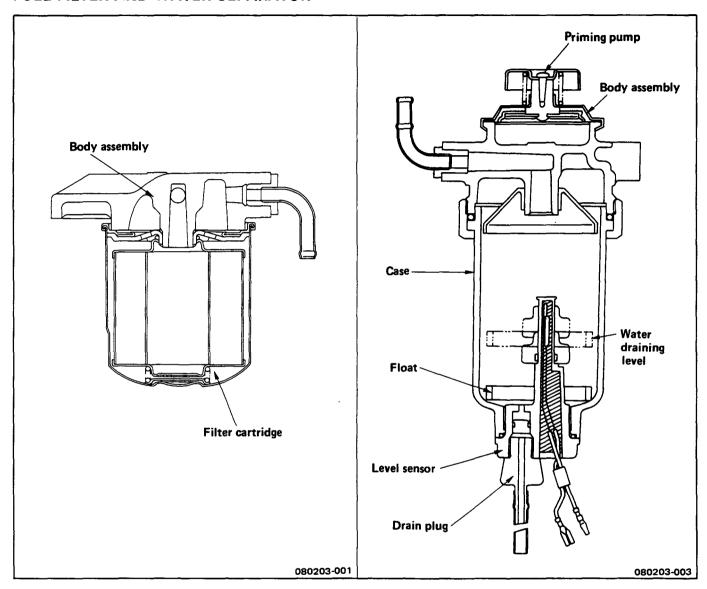
Because engine starting in cold conditions is very difficult, the W-C.S.D. (wax type cold start device) has been developed to provide the optimum fuel injection timing for engine starting by responding to temperature changes.

The thermo-wax piston contains a wax that changes its volume according to the temperture changes of the engine coolant which flows through the unit at all times.

The engine coolant temperature above A °C the wax expands in proportion to the coolant temperature, below A °C it contracts.

The coolant temperature A is classified as -20, -10 and 0°C.

#### **FUEL FILTER AND WATER SEPARATOR**



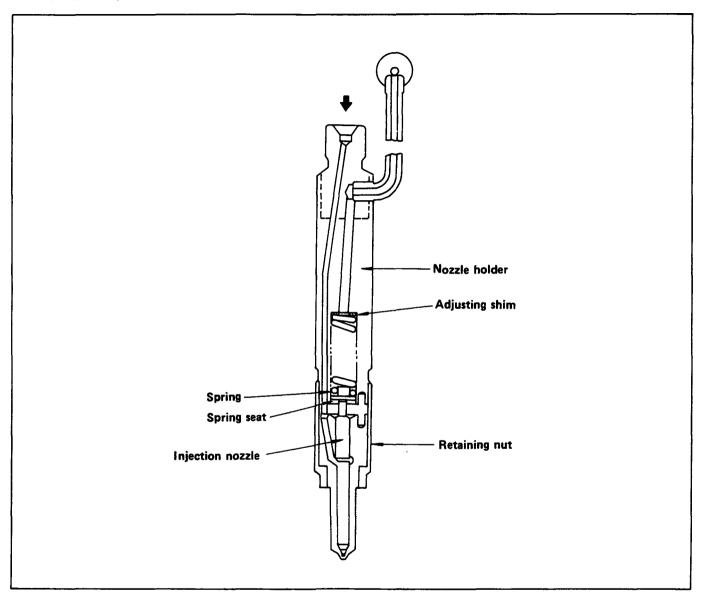
A cartridge type fuel filter and a water separator are used along with the VE type injection pump.

As the inside of the injection pump is lubricated by the fuel which it is pumping, the fuel must be perfectly clean. The fuel filter and the water separator remove water particles and other foreign material from the fuel before it reaches the injection pump.

The water separator has an internal float. When the float reaches the specified level, a warning light comes on to remind you to drain the water from the water separator.

A diaphragm type priming pump is installed at the top of the water separator. It is used during the water draining and the air bleeding procedures.

### **INJECTION NOZZLE**



A hole (with 5 orifices) type injection nozzle is used. It consists of the nozzle body and the needle valve assembly.

The injection nozzle assembly sprays pressurized fuel from the injection pump into the combustion chamber through the nozzle body injection orifice.

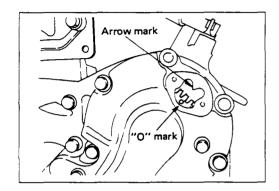
## INJECTION PUMP





## **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



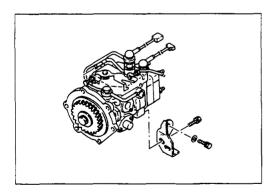


## **Removal Steps**

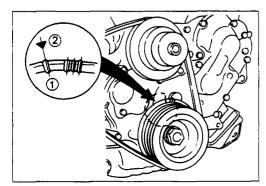
- 1. Disconnect the battery ground cable.
- 2. Disconnect the air cleaner duct.
- 3. Disconnect the PCV hose.
- 4. Remove the head cover.
- 5. Remove the power steering V belt. (if so equipped)
- 6. Disconnect the accelerator cable and harness from injection pump.
- 7. Remove the fuel pipes and injection pipes.
- 8. Remove the cover of timing gear case cover. (injection pump side only)
- 9. Remove the timing hole cover.



10. For ease in reinstalling the injection pump, align the timing "O" mark on the pump gear with the allow mark on the timing gear case cover using the crank shaft turning wrench.



- 11. Remove the six injection pump mounting bolts from the timing gear case cover.
- 12. Remove the rear bracket bolts from the injection pump bracket.
- Pull the injection pump together with pump gear free toward the rear of the engine.



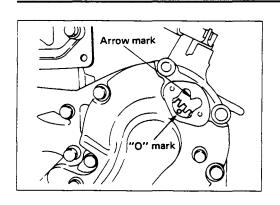


## Installation Steps

To install, follow the removal procedure in reverse order and note the following point.

 Recheck the crankshaft to align the timing mark on the crank pulley with the TDC mark.

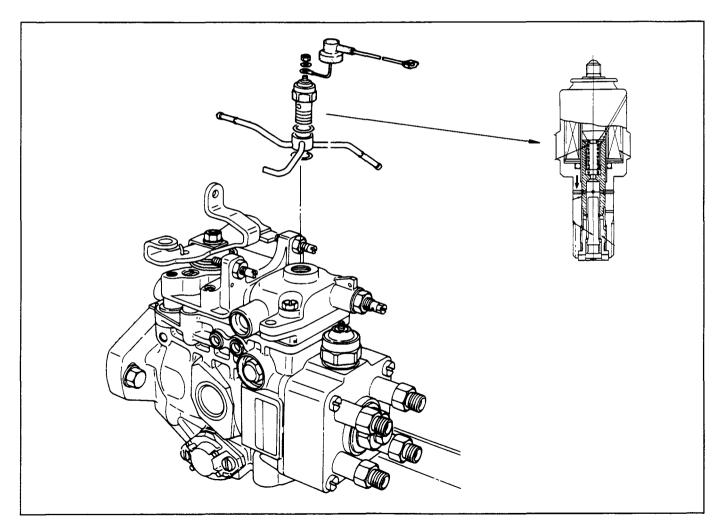
### 6C-12 FUEL SYSTEM



 Install injection pump so that the timing "O" mark on the pump gear the arrow mark on the timing gear case cover.

# SOLENOID VALVE TYPE COLD START DEVICE (C.S.D.) (4JB1T)

## **GENERAL DESCRIPTION**

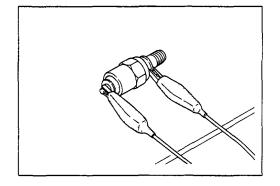


The solenoid timer functions to advance fuel injection timing.



# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacement if excessive wear or damage is discovere during inspection.



## **Solenoid Switch**

Apply the specified voltage to the solenoid valve.

Listen for a click sound.

If there is no clicking sound, the solenoid valve defective and must be replaced.

Test Voltage

12 - 14

# **INJECTION PUMP CALIBRATION DATA**

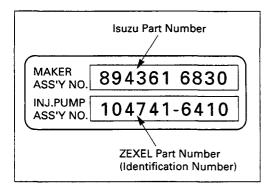
080401

## INJECTION VOLUME ADJUSTMENT

08040101

### **TEST CONDITIONS**

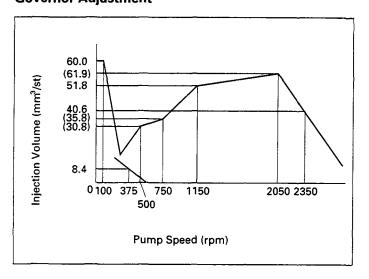
ltem		Item Condition	
Injection nozzle		ZEXEL Part No.: 105780-0060 Bosch Type No. : DNOSD1510	
Injection nozzle holder		ZEXEL Part No.: 105780-2150	
Injection nozzle opening pressure	kg/cm²(psi/kPa)	133 (1,891/13,000)	
Injection line dimensions Inside diameter Outside diameter Length	mm(in)	2 (0.079) 6 (0.236) 450 (17.7)	
Fuel delivery pressure	kg/cm²(psi/kPa)	0.2 (2.84/19.6)	
Test fuel		Bosch Diesel Fuel OL61V11 SAE Standard Test Diesel Fuel (SAE967D)	
Test fuel temperature	°C(°F)	45 - 50 (113 - 122)	
Identification numbers		104746-6190 104746-6161	



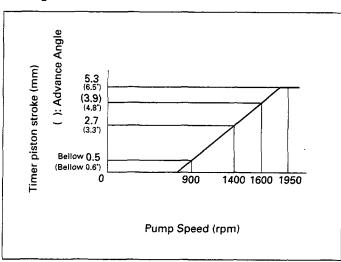
### **IDENTIFICATION PLATE AND NUMBER**

Use the data following the injection pump identification number to adjust the injection volume.

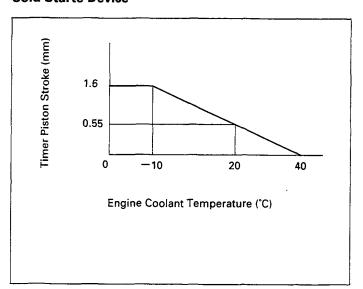
INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM Identification Numbers: 104746-6190 (ISUZU Part Number 8-97132-318-0) Test Fuel: Standard Diesel Fuel SAE J967D (or ISO 4113) Governor Adjustment



# **Timing Advance**



### **Cold Starte Device**

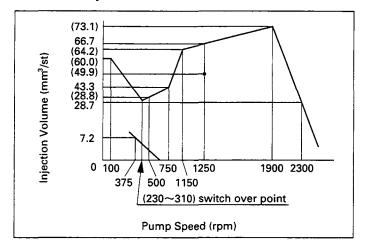


### INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM

Identification Numbers: 104746-6161 (ISUZU Part Number 8-97132-679-1)

Test Fuel: Standard Diesel Fuel SAE J967D (or ISO 4113)

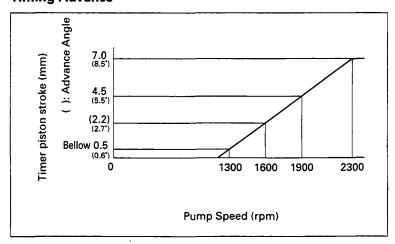
### **Governor Adjustment**



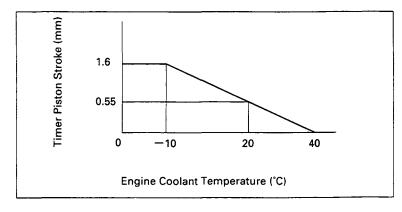
# **Timer and Pump Case Pressure**

Pump speed rpm	Timer piston stroke mm	Pump case pressure kpa (kg/cm²)	Boost pressure kpa (kg/cm²)	Reference
1300	Bellow 0.5		73.3 (0.75)	
1600	(2.2±04)		73.3 (0.75)	
1900	4.5 ±0.2	618±20 (6.3±0.2)	73.3 (0.75)	Base
2300	7.0 +0.4		73.3 (0.75)	

# **Timing Advance**

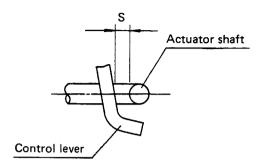


# **Cold Starte Device**



# Vacuum Fast Idle Control Device (V-FICD) Adjustment (If so equipped)

- 1. Set the bracket clearance "S" to 1.5  $\pm$  0.5 mm (0.06  $\pm$  0.02 in).
- 2. Apply 400 mmHg negative pressure to the inside of the actuator. Check that the actuator shaft moves one complete stroke.



# HIGH ALTITUDE EQUIPMENT (If so equipped)

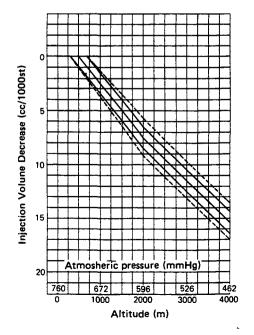
### **Full Load Fuel Injection Volume Adjustment**

- 1. Remove the aneroid compensator cover, the bellows, and the adjusting shims.
- Refer to the appropriate INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM. Make the required adjustments.

Do not adjust the aneroid compensator at this time.

# Aneroid Compensator (ACS) Adjustment (If so equipped)

- 1. Install the adjustment shims, the bellows, and the ACS cover.
- 2. Set the injection pump speed to 1,150 rpm.
- 3. Measure the injection volume for the applicable operating altitude (atmospheric pressure in mmHg).
- Calculate the decreasing injection volume and check it against the graph below.
- 5. If required, use adjusting shims to adjust the aneroid compensator.

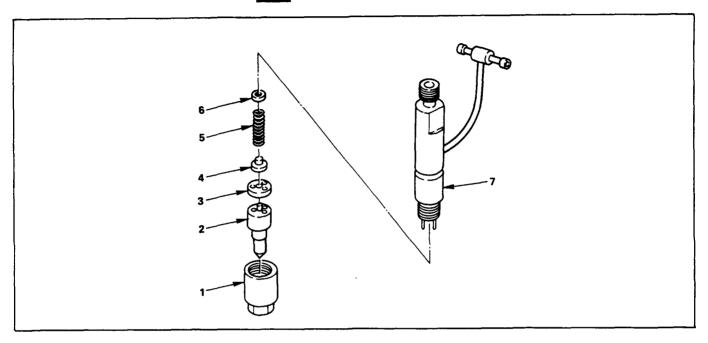


Adjustment limit

# INJECTION NOZZLE

# +++

# **DISASSEMBLY**



# **Disassembly Steps**

- 1. Retaining nut
- ▲ 2. Injection nozzle
  - 3. Spacer
  - 4. Spring seat

- 5. Spring
- 6. Adjusting shim
- 7. Nozzle holder



# **Important Operations**

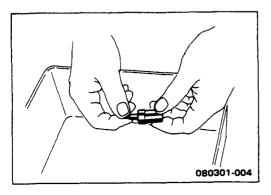
# 2. Injection nozzle

1) Remove the nozzle assemblies from the nozzle holders.

Tag the nozzle assemblies and the nozzle holders to ensure that they are reinstalled in their original positions.

The nozzle assembly and nozzle holder combinations must not be interchanged.

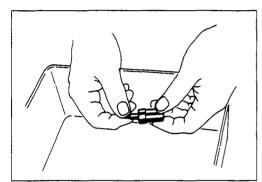
2) Immerse the injection nozzles in a tool tray filled with clean diesel oil to protect them from dust.

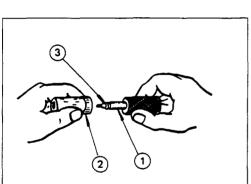


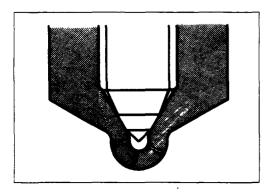


# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.







# **Injection Nozzle Needle Inspection**

- 1. Remove the nozzle needle from the nozzle body.
- 2. Carefully wash the nozzle needle and the nozzle body in clean diesel fuel.
- 3. Check that the nozzle needle moves smoothly inside the injection nozzle body.

If the nozzle needle doesnot move smoothly, it must be repaired (See "Nozzle Lapping Procedure" below).



# Nozzle Lapping Procedure

1. Lap the nozzle needle ① and the nozzle body ② by applying a compound of oxidized chrome and animal oil.

#### Note:

Do not apply an excessive amount of the oxidized chrome and animal oil compound to the injection needle valve seat area ③.

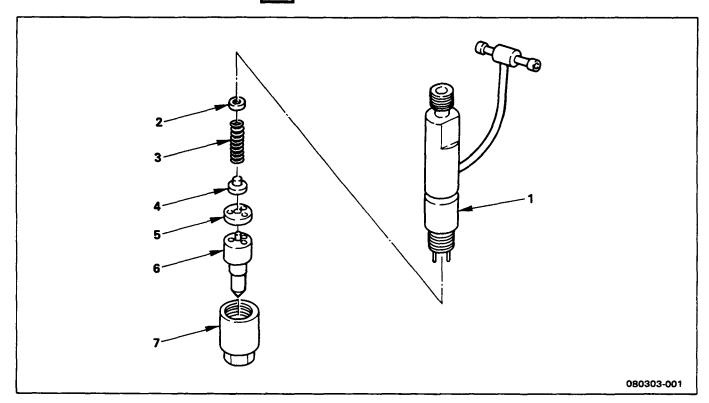
2. Carefully wash the needle valve and the nozzle body in clean diesel fuel after lapping.

# Nozzle Body and Needle Valve Inspection

Check the nozzle body and the needle valve for damage and deformation.

The nozzle and body assembly must be replaced if either of these two conditions are discovered during inspection.

# REASSEMBLY



# **Reassembly Steps**

- 1. Nozzle holder
- 2. Adjusting shim
- 3. Spring
- 4. Spring seat

- 5. Spacer
- 6. Injection nozzle
- ▲ 7. Retaining nut



# **Important Operations**



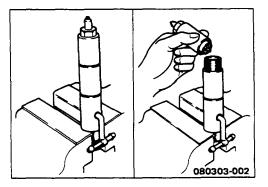
# 7. Retaining Nut

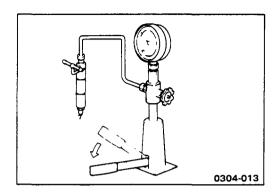
Tighten the retaining nut to the specified torque.

**Retaining Nut Torque** 

kg·m(lb.ft/N·m)

 $3.5 \pm 0.5 (25.3 \pm 3.6/34.3 \pm 4.9)$ 







#### Injection Nozzle Adjustment

The fuel injection starting pressure adjustment of this injection nozzle is done by replacing or decreasing or increasing the number of shims installed.

- Attach the injection nozzle holder to the injection nozzle tester.
- 2) Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.

If the injection nozzle does not open at the specified pressure, install or remove the appropriate number of ajusting shims to adjust it.

Adjusting Shim Availability	mm(i	
Range	0.50 - 1.50 (0.02 - 0.06)	
Increment	0.025 (0.001)	
Total No. of Shims	41	

Removing or installing one shim will increase or decrease the nozzle opening pressure approximately  $3.77~kg/cm^3$  (53.6 psi/369.46 kPa).

#### **WARNING:**

TEST FLUID FROM THE INJECTION NOZZLE TESTER WILL SPRAY OUT UNDER GREAT PRESSURE. IT CAN EASILY PUNCTURE A PERSON'S SKIN. KEEP YOUR HANDS AWAY FROM THE INJECTION NOZZLE TESTER AT ALL TIMES.

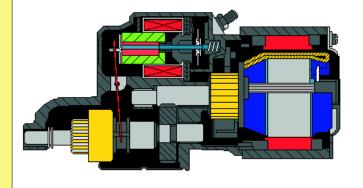


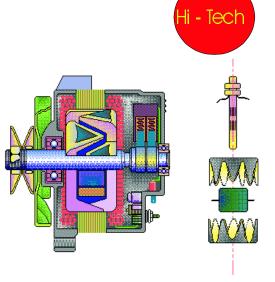


Specs.

Alternator

Starter





# KB TF 140 Diesel Engine Electrical

# **SECTION 6D**

# **ENGINE ELECTRICAL**

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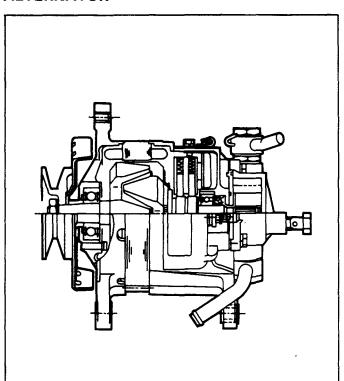
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# **MAIN DATA AND SPECIFICATIONS**

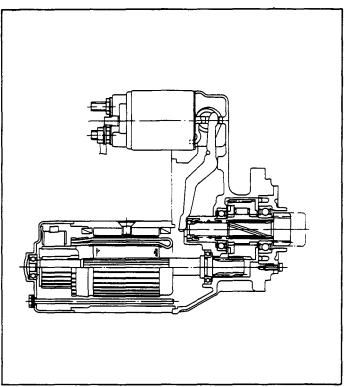
_		Description	
ltem		4JA1	4JB1T
Alternator			
Туре		AC brush with IC regul	lator and vacuum pump
Voltage	V	•	12
Drive and rotation		V-belt, clockwise view	ed from the drive pulley
Ground polarity		Neg	gative
Maximum output	A	40/5000 rpm	50/5000 rpm
Engine speed ratio	to 1	1	.77
Maximum speed	rpm	11	,000
Starter Motor			
Туре		Solenoid	-controlled
Rated voltage	V		12
Rated output	kW	2	2.3
Load characteristics			
Terminal voltage under full load	V	8	.76
Load current	A	3	300
Regulator		-	
Туре			IC
Vacuum pump			
500 mmHg build-up time	e		less at 1,000 rpm less at 5,000 rpm
Maximum vacuum		680 mmHg or n	nore at 5,000 rpm
Weight k	g(lb)	6.0 (	13.23)

# **GENERAL DESCRIPTION**

#### **ALTERNATOR**



#### STARTER MOTOR

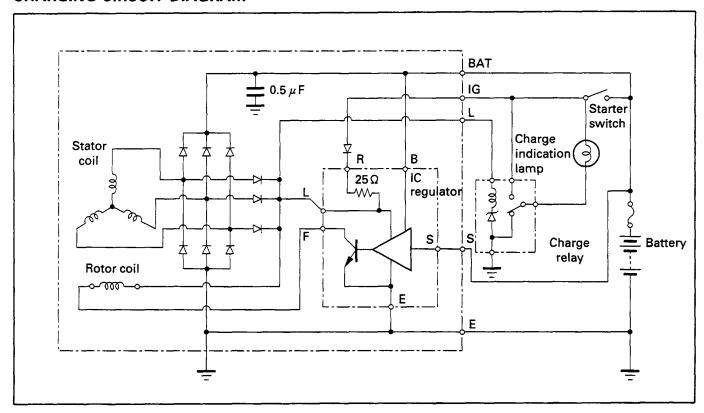


The basic charging system is the IC integral regulator charging system. The internal components are connected electrically as shown in charging circuit diagram.

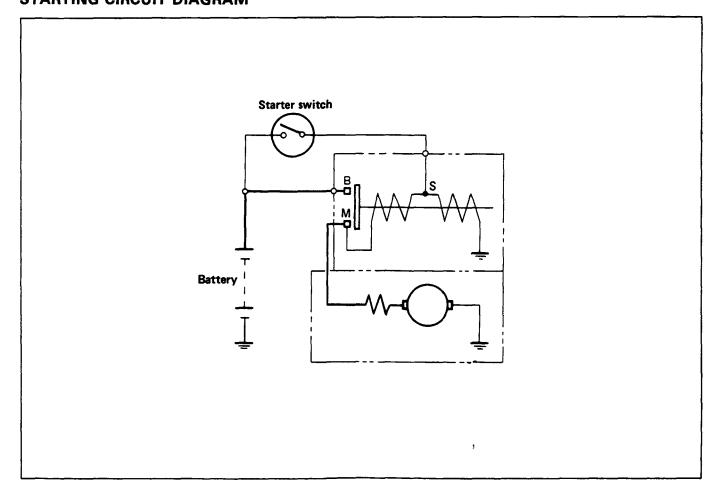
The alternator features a solid state regulator that is mounted inside the alternator. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The alternator voltage setting cannot be adjusted.

The starter motor circuit is composed of a 4-pole 4-brush type direct current series motor, starter switch with safety lock, etc. The starter motor circuit utilizes negative ground polarity.

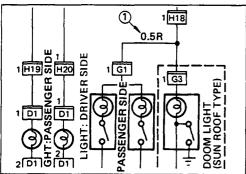
# **CHARGING CIRCUIT DIAGRAM**

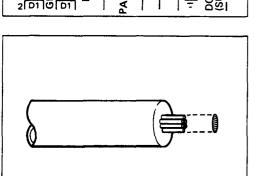


# STARTING CIRCUIT DIAGRAM



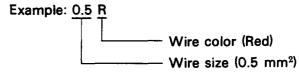
# **WIRE CODING**





# **DESCRIPTION**

Codes used in the circuit diagram represent wire size and color (1).



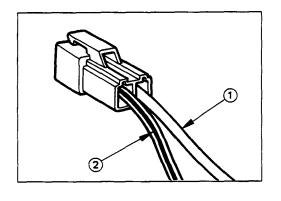
# **WIRE SIZE**

Wire size is specified with the metric gauge system.

The metric gauge system gives the wire size in cross-sectional area measured in square millimeters.

### **WIRE SIZE SPECIFICATIONS**

Wire	size	Number of wires/	Resistance at normal room	Maximum allowable
mm²	AWG	Wire diameter mm(in.)	temperature of 20°C (68°F) $\Omega/m(\Omega/ft)$	current A
0.5	20	7/0.32 (0.013)	0.03250 (0.00991)	11.3
0.85	18	11/0.32 (0.013)	0.02050 (0.00625)	14.8
1.25	16	16/0.32 (0.013)	0.01410 (0.00430)	18.8
2	14	26/0.32 (0.013)	0.00867 (0.00264)	25.4
3	12	41/0.32 (0.013)	0.00550 (0.00168)	34.2
5	10	65/0.32 (0.013)	0.00347 (0.00106)	45.9
8	8	50/0.45 (0.018)	0.00228 (0.00070)	59.8
15	6	84/0.45 (0.018)	0.00136 (0.00042)	82.8
20	4	41/0.80 (0.031)	0.00087 (0.00027)	110.9
30	2	70/0.80 (0.031)	0.00051 (0.00016)	147.0



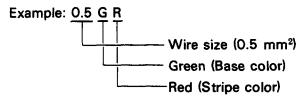
# WIRE COLOR

All wires have color-coded insulation.

Wires belonging to a system's main harness will have a single color (1).

Wires belonging to a system's sub-circuits will have a colored stripe (2).

Striped wires use the following code to show wire size and colors.



Abbreviations are used to indicate wire color within a circuit diagram.

Refer to the following table.

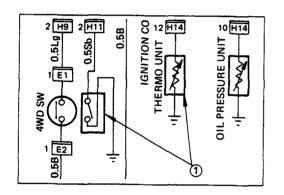
### WIRE COLOR-CODING

Color-coding	Meaning	Circuits
В	Black	Starter circuit and grounding circuit
W	White	Charging circuit
R	Red	Lighting circuit
G	Green	Signal circuit
Y	Yellow	Instrument circuit
L	Blue	Wiper circuit
0	Orange	
Br	Brown	
Lg	Light green	
Gy	Grey	Other circuits
Р	Pink	
Sb	Sky blue	
V	Violet	

# **SYMBOLS AND ABBREVIATIONS**

# **DESCRIPTION**

The symbols and abbreviations used in the circuit diagram make the diagram easier to read and understand.



# **SYMBOLS**

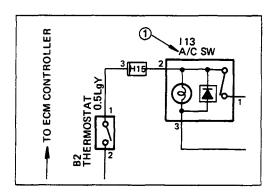
The illustration at the left shows a typical symbol ① used in circuit diagrams.

Refer to the following table.

# SYMBOL AND MEANING

Symbol	Meaning	Symbol	Meaning
	Fuse	9	Single filament bulb
	Main fuse		Double filament bulb
	Fusible link wire	—(M)-—	Motor
-00	Switch	- mm	Variable resistor
- O O	Switch	000	Coil (Inductor)

Symbol	Meaning	Symbol	Meaning
	Contact wiring		Relay Note: Relay contact shown in
0 0 + -	Battery		the wiring diagram indi- cates condition before actuation.
<b>H</b>	Diode		Connector
<b>E</b>	Electronic part		Light emitting diode
	Resistor		Reed switch
	Speaker		Condenser



# **ABBREVIATIONS**

The illustration at the left shows a typical abbreviation ① used in circuit diagrams.

These same abbreviations may also appear in the text. Refer to the following table.

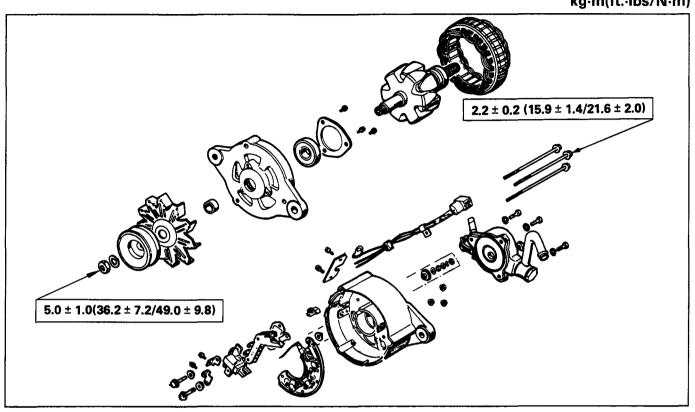
# **ABBREVIATION AND MEANING**

Abbreviation	Meaning	Abbreviation	Meaning
RH	Right-hand side	STD	Standard equipment
LH	Left-hand side	ОРТ	Optional equipment
sw	Switch	W/	With
M/T	Manual transmission	wo/	Without
A/T	Automatic transmission	OD	Overdrive
FT	Front	ACC	Accessories
RR	Rear	A/C	Air conditioner
FLW	Fusible link wire	ATF	Automatic transmission fluid
TEMP	Temperature	vsv	Vacuum switching valve
ECM	Electronic control module		

# **TORQUE SPECIFICATIONS**

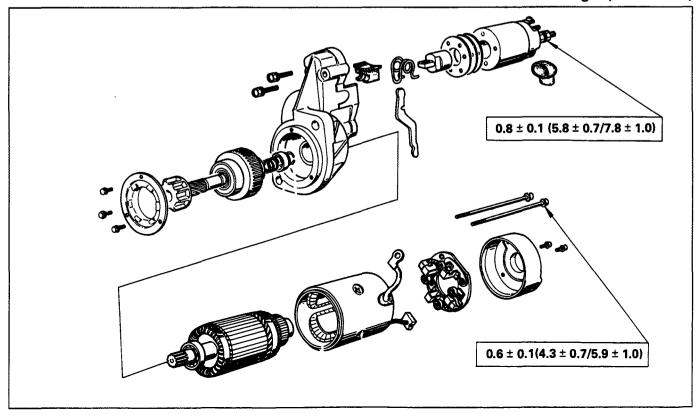
# **STARTER MOTOR**

kg·m(ft.·lbs/N·m)



# **ALTERNATOR**

kg·m(ft.·lbs/N·m)



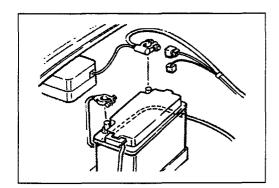
# **ALTERNATOR**





# REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.





# Important Operations – Removal

# **Cooling Fan Belt**

- Disconnect the battery cables at the battery terminals.
- 2) Loosen and remove the fan belt adjusting plate bolts.
- 3) Remove the fan belt from the alternator drive pulley.

#### **Alternator**

Remove the alternator bolt and the alternator from the bracket.



# Important Operations – Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



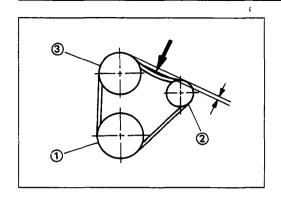
#### Alternator

- 1) Install the alternator to the bracket.
- 2) Tighten the alternator bolt to the specified torque.

Alternator Bolt Torque

kg•m(lb.ft/N•m)

 $3.8 \pm 1.0 (27.5 \pm 7.2/37.2 \pm 9.8)$ 



# **Cooling Fan Belt**

- 1) Hold the alternator toward the engine.
- 2) Install the fan belt to the three pulleys.
  - (1) Crankshaft pulley
  - (2) Water pump pulley
  - (3) Alternator pulley



- 3) Adjust the fan belt tension.
  - (1) Use a bar to pull the alternator away from the engine as far as possible.
  - (2) Use your hand to apply a pressure of 10 kg (22 lb/98N) to the area of the fan belt indicated by the arrow in the illustration.

There should be from 8-12 mm (0.3-0.5 in) of belt deflection.



4) Tighten the adjusting plate bolts to the specified torque.

Pulley Nut Torque

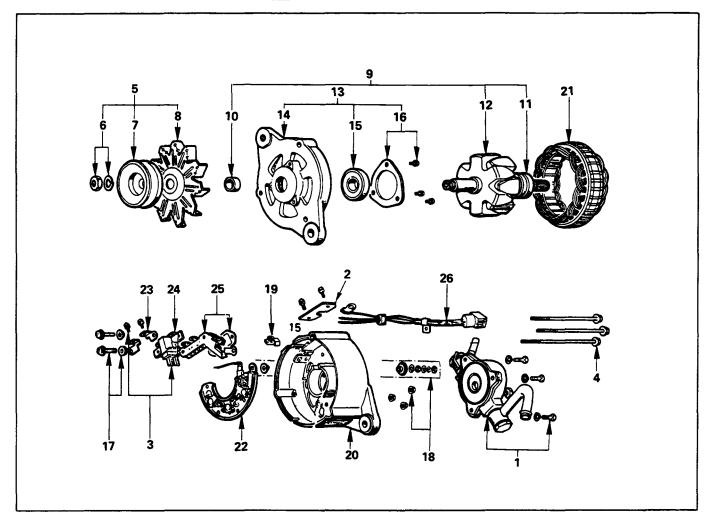
 $kg \cdot m(lb \cdot ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

5) Reconnect the battery cable to the battery.

# +++

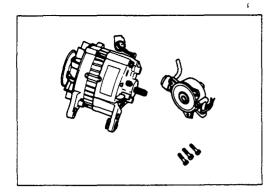
# DISASSEMBLY



# **Disassembly Steps**

- ▲ 1. Vacuum pump
- ▲ 2. Cover
- ▲ 3. Brush
- ▲ 4. Through bolt
- ▲ 5. Pulley assembly
  - 6. Pulley nut
  - 7. Pulley
  - 8. Fan
- ▲ 9. Rotor assembly
  - 10. Spacer
  - 11. Ball bearing
  - 12. Rotor
- ▲ 13. Front cover assembly

- 14. Front cover
- 15. Ball bearing
- 16. Bearing retainer
- 17. Screw
- ▲ 18. Terminal bolt and nut
  - 19. Condenser
- ▲ 20. Rear cover
- ▲ 21. Stator
- ▲ 22. Diode
  - 23. Holder plate
  - 24. Brush holder
- ▲ 25. IC regulator assembly
  - 26. Lead wire

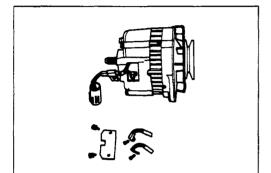




# **Important Operations**

# 1. Vacuum Pump

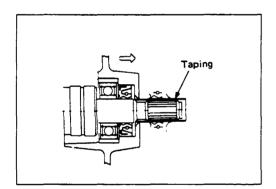
- 1) Loosen the vacuum pump fixing bolts.
- 2) Support the vacuum pump center plate.
- 3) Carefully remove the vacuum pump.



#### 2. Cover

#### 3. Brush

- 1) Remove the cover.
- 2) Remove the brush fixing bolts.
- 3) Remove the brushes from the brush holder.



### 4. Through Bolt

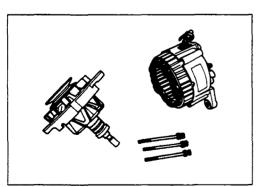
# 9. Rotor Assembly

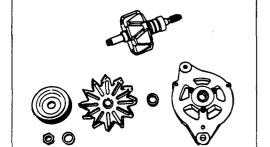
- 1) Loosen the through bolts.
- 2) Remove the rotor and front cover assembly from the stator and rear cover assembly.

Do not allow the stator to separate from the rear cover.

Take care not to damage the oil seal.

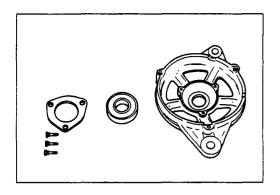
3) Tape the rotor splines to protect them from damage.

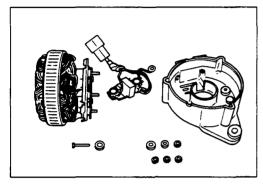


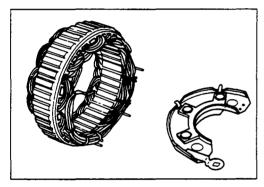


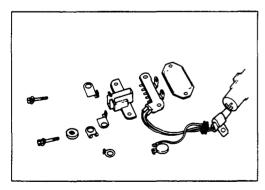
# 5. Pulley Assembly

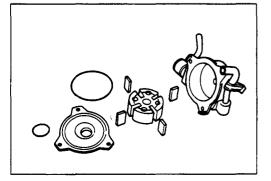
- 1) Carefully clamp the rotor assembly in a vise.
- 2) Loosen the pulley nut.
- 3) Remove the pulley and the front cover from the rotor.











## 13. Front Cover Assembly

- 1. Remove the front cover bearing retainer screws.
- 2. Remove the bearing.

- 18. Terminal Nut and Bolt
- 20. Rear Cover
- 21. Stator
- 22. Diode
  - 1) Loosen the terminal nuts and bolts.
  - 2) Remove the insulators and the washers.
  - 3) Remove the stator together with the diodes.
  - 4) Disconnect the stator coil leads between each diode and the N-terminal by melting the solder connection. Hold the lead wire between the solder and the diode with a pair of long nose pliers.

This will prevent heat transfer and resultant damage to the diode.

#### 25. IC Regulator Assembly

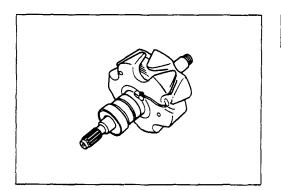
- 1) Melt away the solder from the IC regulator holder plate terminal.
- 2) Remove the IC regulator assembly.

Remove the center plate, rotor and vane in the vacuum pump.



# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacement if excessive wear or damage is discovered during inspection.



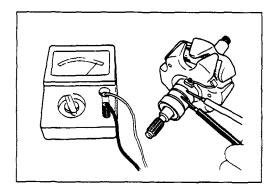


# **ROTOR ASSEMBLY**

- Inspect the slip ring faces for dirt and pitting.
   Wipe away any dirt with a clean cloth soaked in alcohol.
- 2. Measure the slip ring diameter.

mm(in)
Limit
30.6 (1.183)

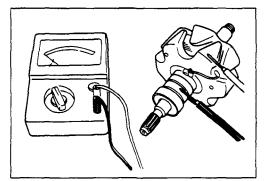
If the slip ring diameter is less than the specified limit, the slip rings must be replaced.





3. Measure the rotor coil resistance.

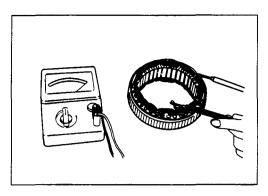
Rotor Coil Resistance at 20°C (	68°F) ohms
Standard	4.2





4. Check for continuity between the slip rings and the rotor core or shaft.

If there is continuity, the entire rotor assmbly must be replaced.





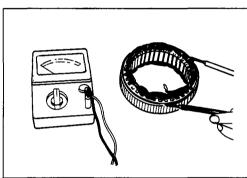
# STATOR COIL ASSEMBLY

1. Check for continuity across the stator coils.

If there is no continuity, the stator coils must be replaced.

Resistance Between The Terminal "N" and the Coil Ends

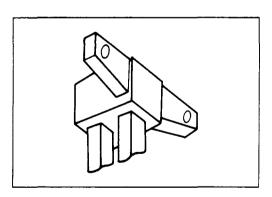
(Reference)	ohms
Standard	0.1





2. Check for continuity between each stator coils and the stator core.

If there is continuity, the stator coils must be replaced.



# **BRUSH**

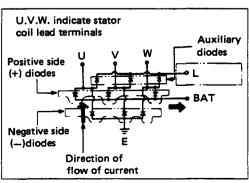
Each brush has a line to indicate whether or not the brush is serviceable.

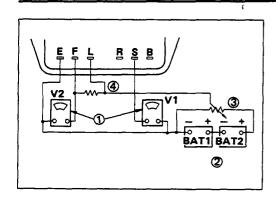
If the line is not visible, the brush must be replaced.

Brush Length (Reference)	mm(in)
Standard	Limit
20 (0.8)	6 (0.2)

# DIODE

- Check for continuity between the battery and each of the three stator coil lead terminals.
   If there is continuity, the diode is normal.
   If there is no continuity, the diode must be replaced.
- Reverse the polarity of the test probes.
   If there is no continuity, the diode is normal.
   If there is continuity, the diode must be replaced.





#### IC REGULATOR

The IC regulator may be tested with either a circuit tester or a pair of standard voltmeters.

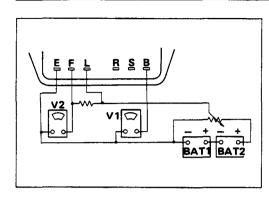
Refer to the illustration.

- (1) Circuit tester (or voltmeter) range is from 0 to 50 volts in 0.5 volt increments.
- (2) Two 12-volt batteries are required.
- (3) Note the variable resistor.
- (4) This resistor is rated at 100 watts or 3 ohms.



Refer to the wiring diagram in the illustration when testing the IC regulator.

#### **6D-18 ENGINE ELECTRICAL**



- 1 Connect the batteries in series.
- 2. Measure the battery power (voltage).

Battery Power 20 — 26

- 3. Connect the circuit tester (or voltmeter V2) as shown in the illustration.
- 4. Set the variable resistor (3) to zero.
- 5. Slowly increase the resistance of the variable resistor toward the build-up point.

Measure the voltage between E and F.

As long as the resistance is below the build-up point, the voltage reading should be stable and less than two volts.

When the resistance exceeds the build-up point, the voltage reading should be two volts or greater.

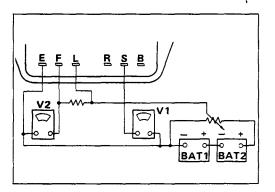
If the voltage does not exceed two volts after reaching the build-up point, the IC regulator must be replaced.

- 6. Return the variable resistor to zero.
- 7. Connect the circuit tester (or voltmeter V1) as shown in the illustration.
- 8. Measure the voltage at terminals S, L, and E.
- 9. Slowly increase the resistance of the variable resistor.

Note the point at which the voltage quickly builds up to between 2 and 6 volts.

This will indicate the point at which the voltage regulator begins to function.

If the measured voltage is outside the specified range, the voltage regulator must be replaced.



10. Repeat Steps 3 through 5 to measure the voltage between terminals B, L, and E.

Refer to the illustration.

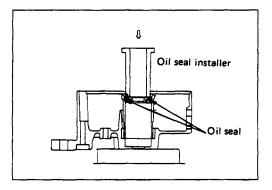
The regulator voltage should be between 0.5 and 3 volts higher than the measured voltage.

If the regulator voltage is outside this range, the voltage regulator must be replaced.



#### Oil Seal

Check the rear cover oil seal bore for oil leakage.

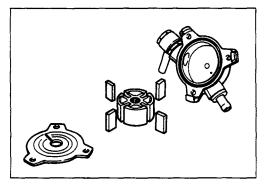


# Oil Seal Replacement

1. Use a screwdriver to remove the oil seal from the rear cover side.

Take care not to damage the oil seal bore.

- Discard the used oil seal.
- 3. Use the oil seal installer to install the new oil seal.





# Vacuum Pump

# Vacuum Pump Disassembly

- 1. Remove the center plate from the vacuum pump housing.
- 2. Remove the vacuum pump rotor and the vanes from the housing.



#### Inspection

# **Vacuum Pump Housing and Center Plate**

Inspect the vacuum pump housing and the center plate for excessive wear, abrasion, and scoring.

If any of these conditions are present, the vacuum pump housing and center plate must be replaced.

#### Vane

Inspect the vanes for excessive wear and damage.

Replace all four vanes if either of these conditions are present.

Never replace only one vane.

#### Rotor

1. Inspect the rotor for excessive wear, abrasion, and scoring.

Pay particular attention to the internal spline.

Replace the rotor if any of these conditions are present.

Inspect the alternator rotor shaft splines for backlash.

Replace the rotor if backlash is present.



1. Carefully force the valve from the "B" side as shown in the illustration.

The valve must move smoothly.

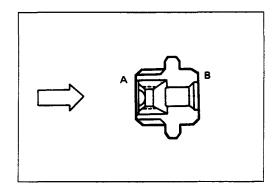
If it does not, the check valve must be replaced.

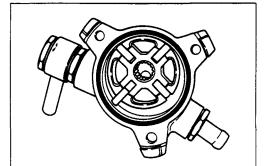
2. Apply compressed air to the "A" side.

Air Pressure  $\frac{\text{kg/cm}^2(\text{psi/kPa})}{1-5(14-71/98-490)}$ 

Check for air leakage from the check valve.

If there is air leakage, the valve must be replaced.



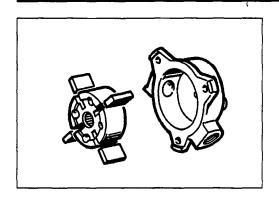




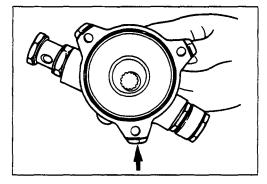
# Vacuum Pump Reassembly

1. Install the vanes to the rotor slits.

The rounded side of the vanes must be facing the rotor housing.



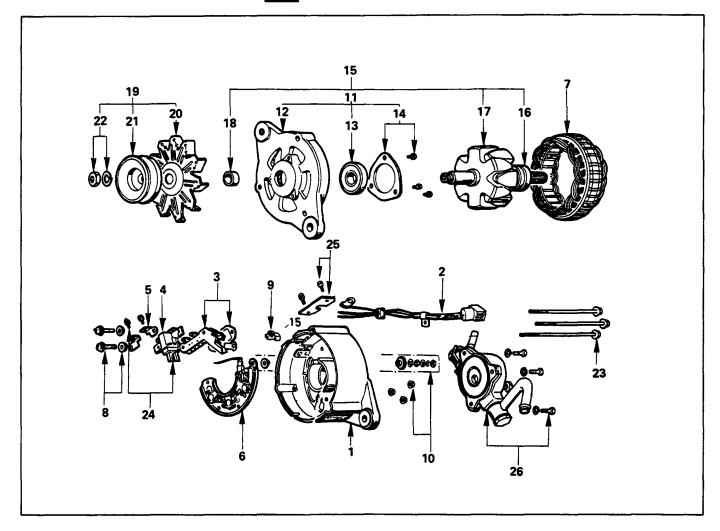
2. Install the rotor with the concave side facing the center plate.



3. Install the center plate to the rotor housing. Be sure to use a new O-ring.

# -‡+ RE

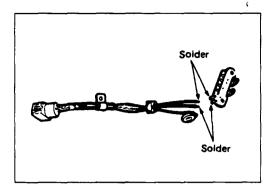
# **REASSEMBLY**



# **Reassembly Steps**

- 1. Rear cover
- ▲ 2. Lead wire
- ▲ 3. IC regulator assembly
  - 4. Brush holder
  - 5. Holder plate
- ▲ 6. Diode
- ▲ 7. Stator
  - 8. Screw
  - 9. Condenser
  - 10. Terminal bolt and nut
  - 11. Front cover assembly
  - 12. Front cover
  - 13. Ball bearing

- 14. Bearing retainer
- ▲ 15. Rotor assembly
  - 16. Ball bearing
  - 17. Rotor
  - 18. Spacer
- ▲ 19. Pulley assembly
  - 20. Fan
  - 21. Pulley
  - 22. Nut and washer
- ▲ 23. Through bolt
- ▲ 24. Brush
- ▲ 25. Cover
- ▲ 26. Vacuum pump



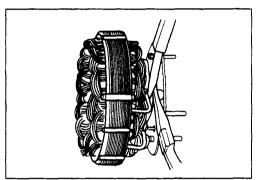


# **Important Operations**

#### 2. Lead Wire

#### 3. IC Regulator

Solder the IC regulator lead wires.

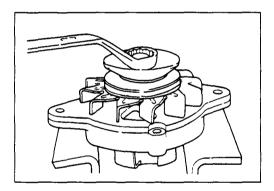


#### 6. Diode

#### 7. Stator

Use a pair of long-nose plier to connect the stator coil leads and the diode leads.

Finish the work as quickly as possible to prevent the diode from heat transferred by the soldering.





### 15. Rotor Assembly

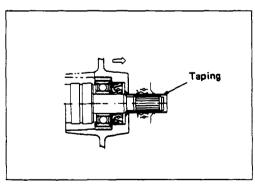
# 19. Pulley Assembly

Clamp the rotor in a vise and install the pulley nut.

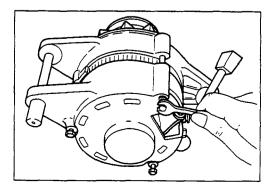
**Pulley Nut Torque** 

kg·m(lb·ft)

 $5.0 \pm 1.0 (36.2 \pm 7.2/49.0 \pm 9.8)$ 



Remove the tape from the splines.





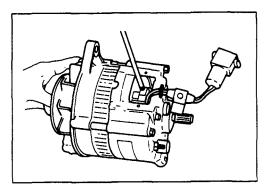
#### 23. Through Bolt

- 1. Place a pilot bar into the through bolt hole to align the front cover and the rear cover.
- 2. Install the through bolts and tighten them to the specified torque.

Through Bolt Torque

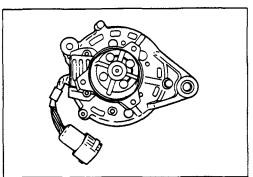
kg·m(lb·ft)

 $0.65 \pm 0.5 (4.7 \pm 3.6/6.3 \pm 4.9)$ 



#### 24. Brush

Install the brush into the brush holders.





### 25. Cover

Install the brush cover and tighten the cover bolts to the specified torque.

Brush	Cover	Bolt	Torque	
	_			

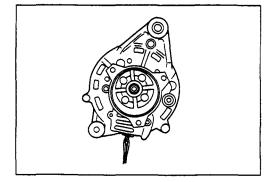
kg·m(lb·ft)

$$0.35 \pm 0.5 (2.5 \pm 3.6/3.4 \pm 5.0)$$

# 26. Vacuum Pump

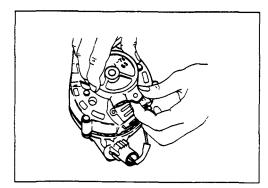
Position the rotor, with the serrated boss turned up, on the center plate and housing.

Align the holes in the center plate and the rotor.



Install vanes into slits in rotor.

The vanes should be installed with the chamfered side facing outward.

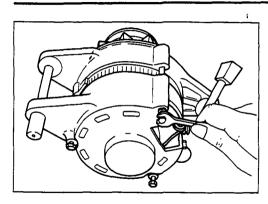


Install the vacuum pump housing.

Make sure that the O-ring is not projecting beyond the slots of the center plate.

Take care so that no scratching takes place on the vane resulted by contact with the housing.

kg-m(lb-ft)



Install the housing in the alternator and fix it with the three bolts.

Supply engine oil (5cc or so) from the oil port and check that the alternator pulley can be turned smoothly with your hand.



Alternator Housing Bolt Torque  $0.65 \pm 0.5 (4.7 \pm 3.6/6.3 \pm 4.9)$ 

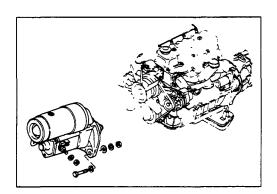
# STARTER MOTOR





# **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.





# Important Operations — Removal

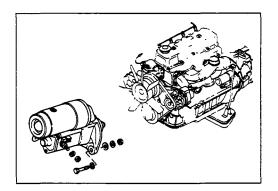
#### **Starter Motor**

- 1) Disconnect the battery cable and the ground cable at the battery terminals.
- Disconnect the magnetic switch cable at the terminal bolts.
- 3) Disconnect the battery cable at the starter motor and the ground cable at the cylinder body.
- 4) Remove the starter motor from the engine.



# Important Operations - Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





#### **Starter Motor**

- 1) Install the starter motor to the rear plate.
- 2) Tighten the starter motor bolts to the specified torque.

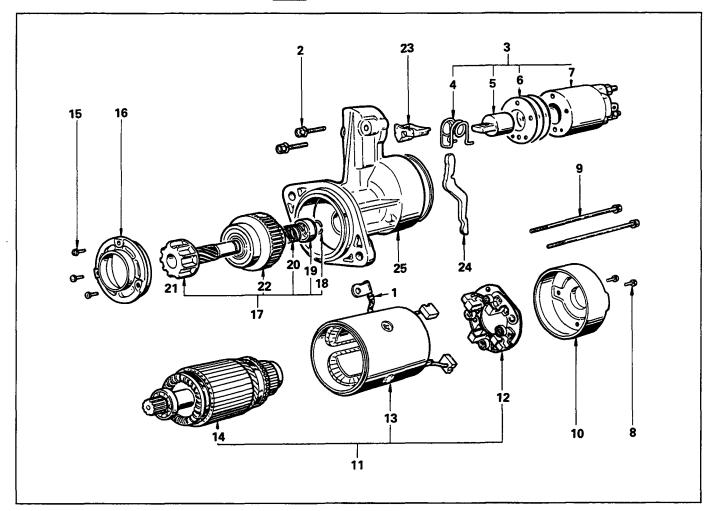
Starter Motor Bolt Torque

kg·m(lb·ft/N·m)

 $8.8 \pm 1.9 (63.6 \pm 16.6/86.2 \pm 18.6)$ 

- 3) Reconnect the battery cable at the starter motor and the ground cable at the cylinder body.
- 4) Reconnect the battery cable and the ground cable at the battery terminals.

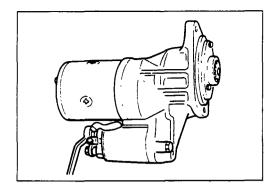
# DISASSEMBLY



# **Disassembly Steps**

- ▲ 1. Lead wire
  - 2. Bolt
- ▲ 3. Magnetic switch assembly
  - 4. Torsion spring
  - 5. Plunger
  - 6. Adjusting shims
  - 7. Magnetic switch
- ▲ 8. Screw
- ▲ 9. Through bolt
- ▲ 10. Rear cover
- ▲ 11. Motor assembly
- ▲ 12. Brush holder
- ▲ 13. Yoke

- ▲ 14. Armature
  - 15. Screw
- ▲ 16. Bearing retainer
- ▲ 17. Pinion assembly
  - 18. Pinion stopper clip
  - 19. Pinion stopper
  - 20. Return spring
  - 21. Pinion shaft
  - 22. Clutch
- ▲ 23. Dust cover
- ▲ 24. Shift lever
- ▲ 25. Gear case

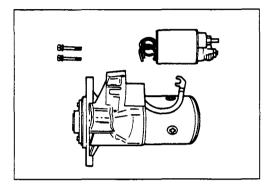


# V

# **Important Operations**

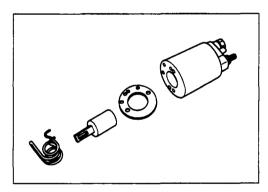
### 1. Lead Wire

Disconnect the lead wire at the magnetic switch.

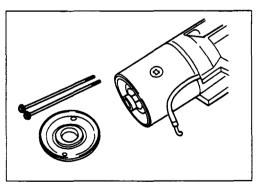


# 3. Magnetic Switch Assembly

Remove the magnetic switch bolts, then remove the switch from the shift lever.

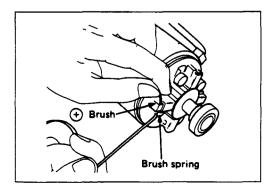


Remove the torsion spring from the magnetic switch.



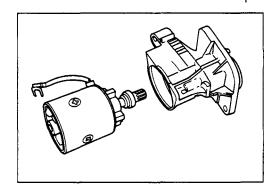
- 8. Screw
- 9. Through Bolt
- 10. Rear Cover

Remove the through bolts, then remove the rear cover.



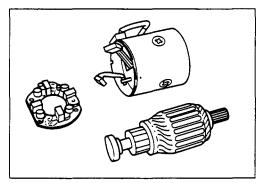
### 11. Motor Assembly

Remove the four brushes from the brush holders.



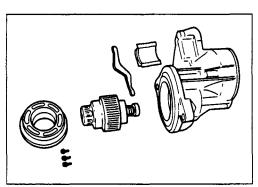
Remove the yoke along with the armature and the brush holder from the gear case.

Remove the brushes and commutator carefully so as not to allow them in contact with the adjacent parts.

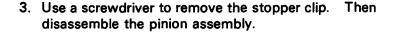


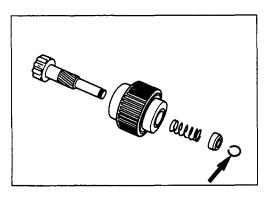
- 12. Brush Holder
- 13. Yoke
- 14. Armature

Remove the brush holder and pull out the armature assembly free from the yoke.



- 16. Bearing Retainer
- 17. Pinion Assembly
- 23. Dust Cover
- 24. Shift Lever
- 25. Gear Case
  - 1. Remove the bearing retainer.
  - 2. Remove the pinion from the gear case.

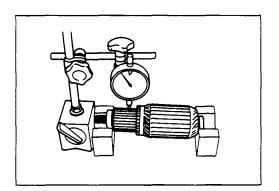






# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacement if excessive wear or damage is discovered during inspection.

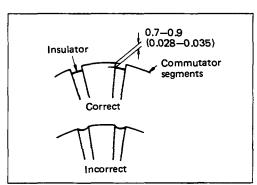




#### **ARMATURE**

Measure the commutator run-out.
 Replace the commutator if the measured run-out exceeds the specified limit.

Commutator Run-Out	mm(in)	
Standard	Limit	
0.02 (0.001)	0.05 (0.002)	



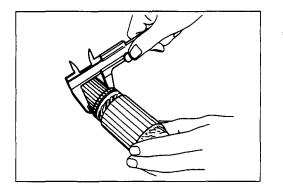


- 2. Check the commutator mica segments for excessive wear.
- 3. Measure the mica segment depth.

Mica Segment Depth	mm(in)	
Standard	Limit	
0.7-0.9 (0.028-0.035)	0.2 (0.01)	

If the mica segment depth is less than the standard but more than the limit, the commutator may be reground.

If the mica segment depth is less than the limit, the commutator must be replaced.

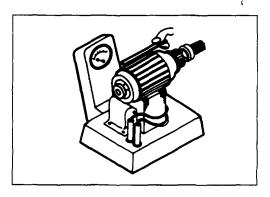


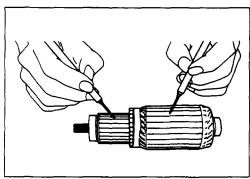


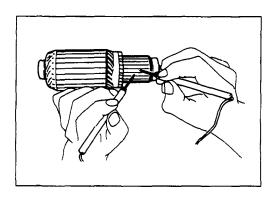
4. Measure the commutator outside diameter.

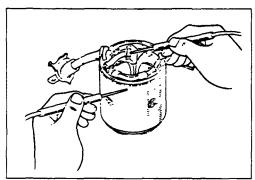
Commutator Outside Diamete	er mm(in)
Standard	Limit
35 (1.4)	34 (1.3)

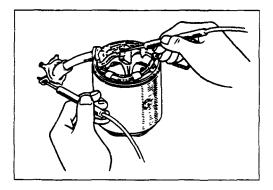
If the measured outside diameter is less than the specified limit, the commutator must be replaced.











- 5. Test the armature for short circuiting.
  - a. Place the armature in a growler tester.
  - b. Hold a hacksaw blade against the armature core.

If the armature has a short circuit, the hacksaw blade will vibrate.

Replace the armature if there is a short circuit.

- 6. Use a circuit tester to check the armature for grounding.
  - 1) Hold one probe of the circuit tester against the commutator segment.
  - 2) Hold the other circuit tester probe against the armature core.

If the circuit tester indicates continuity, the armature is grounded.

The armature must be replaced.

- 7. Use the circuit tester to check the armature for continuity.
  - 1) Hold the circuit tester probes against two armature core segments.
  - 2) Repeat Step 1 at different segments of the armature core.

There should be continuity between all segments of the armature core.

If there is not, the armature must be replaced.

#### YOKE

- Use a circuit tester to check the field winding ground.
  - 1) Hold one circuit tester probe against the field winding end or brush.
  - 2) Hold the other circuit tester probe against the bare surface of the yoke body.

There should be no continuity.

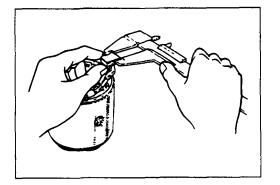
If there is continuity, the field coil is grounded.

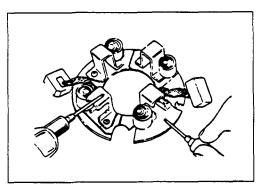
The yoke must be replaced.

- 2. Use the circuit tester to check the field winding continuity.
  - 1) Hold one circuit tester probe against the "C" terminal lead wire.
  - 2) Hold the other circuit tester probe against the field winding brush.

There should be continuity.

If there is no continuity, the yoke must be replaced.







#### **BRUSH AND BRUSH HOLDER**

1. Use a vernier caliper to measure the brush length (four brushes).

Replace the brushes as a set if one or more of the brush lengths is less than the specified limit.

Brush Length	mm(in)	
Standard	Limit	
14.5 (0.57)	9.5 (0.37)	

2. Use a circuit tester to check the brush holder insula-

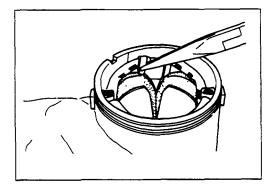
Touch one probe to the holder plate and the other probe to the positive brush holder.

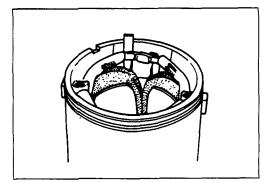
There should be no continuity.

3. Inspect the brushes for excessive wear.

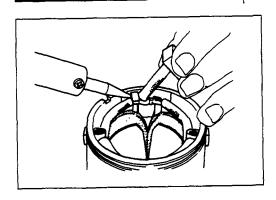
If the negative brushes have excessive wear, the entire brush holder assembly must be replaced.

If the positive brushes have excessive wear, only the brushes must be replaced.

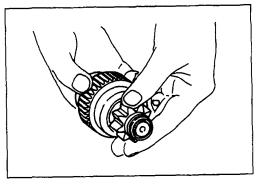




- 1) Use a pair of side cutters to cut the lead wire from the brush.
- 2) File away any foreign material clinging to the edge of the lead wire.
- 3) Remove the brushes from the brush holder.
- 4) Install the new brushes.
- 5) Straighten the bent portion of the clip.
- 6) File away any foreign material clinging to the clip surface.



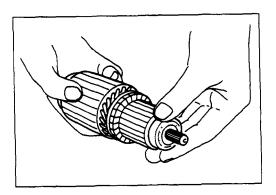
- 7) Place the lead wire in the clip.
- 8) Bend the clip shut.
- 9) Solder the brush lead.
- 10) Repeat the procedure for each of the brushes.





## OVERRUNNING CLUTCH

- Inspect the overrunning clutch gear teeth for excessive wear and damage.
  - Replace the overrunning clutch if necessary.
- Rotate the pinion clockwise.It should turn smoothly.
- 3. Try to rotate the pinion in the opposite direction. The pinion should lock.





#### **BEARING**

Inspect the bearings for excessive wear and damage. Replace the bearings if necessary.

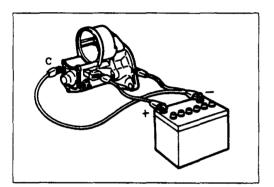


#### **MAGNETIC SWITCH**

The following tests must be performed with the starter motor fully assembled.

The yoke lead wire must be disconnected from the "C" terminal.

To prevent coil burning, complete each test as quickly as possible (within three to five seconds).

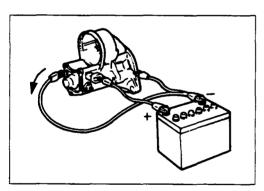




Temporarily connect the solenoid switch between the clutch and the housing and run the following test. Complete each test within three to five seconds.

#### 1. Pull-in Test

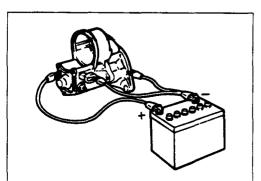
Connect the battery negative terminal with the solenoid switch body and the C terminal. When current is applied to the 50 terminal from the battery positive terminal, the pinion should flutter.





#### 2. Hold-in Maintenance Test

Disconnect the lead at the C terminal. The pinion should continue to flutter.



#### 3. Return Test

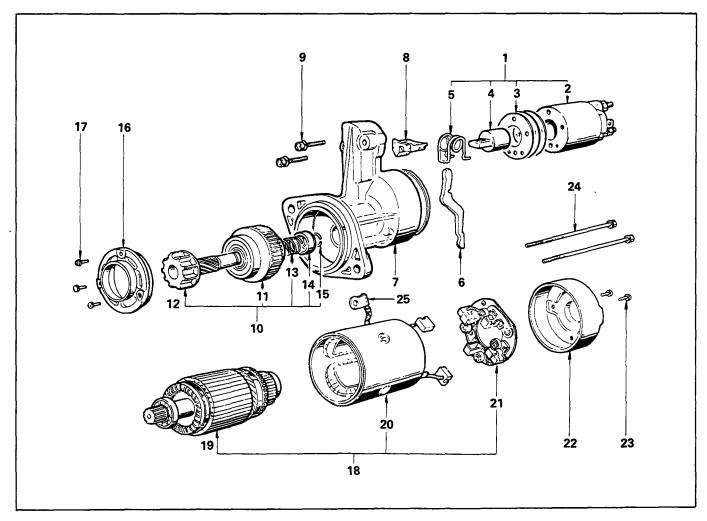
Connect the battery negative leads to the starter body and the 50 terminal.

Connect the battery positive lead at the C terminal.

The pinion should return to its home position.

# \*\*

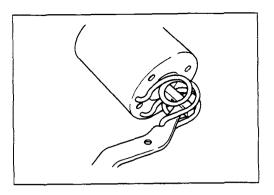
# **REASSEBMBLY**

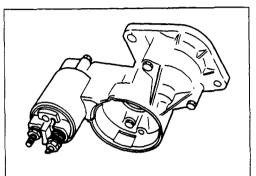


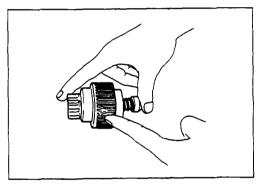
#### **Reassembly Steps**

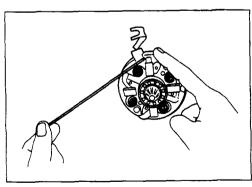
- ▲ 1. Magnetic switch assembly
  - 2. Magnetic switch
  - 3. Adjusting shims
  - 4. Plunger
  - 5. Torsion spring
  - 6. Shift lever
- ▲ 7. Gear case
- ▲ 8. Dust cover
  - 9. Bolt
- ▲ 10. Pinion assembly
  - 11. Clutch
  - 12. Pinion shaft
  - 13. Return spring

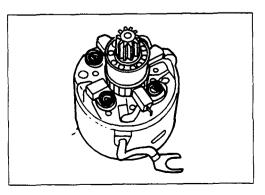
- 14. Pinion stopper
- 15. Pinion stopper clip
- 16. Bearing retainer
- 17. Screw
- 18. Motor assembly
- 19. Armature
- 20. Yoke
- ▲ 21. Brush holder
  - 22. Rear cover
  - 23. Screw
- ▲ 24. Through bolt
- ▲ 25. Lead wire













### Important Operations

#### 1. Magnetic Switch Assembly

- 1. Attach the torsion spring to the hole in the magnetic switch as illustrated.
- 2. Insert the shift lever into the plunger hole of the magnetic switch.

#### 7. Gear Case

#### 8. Dust Cover

- Install the magnetic switch assembly in the gear case.
- 2. Install the dust cover.

Dust Cover Bolt Torque kg·m(lb·ft/N·m)  $0.75 \pm 0.5 (5.4 \pm 3.6/7.4 \pm 5)$ 



#### 10. Pinion Assembly

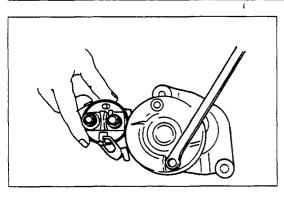
Apply a coat of grease to the reduction gear and install the pinion assembly to the armature shaft.

#### 21. Brush Holders

1. Install the brushes into the brush holder with raising the spring end of the brush spring.

Take care not to damage the commutator face.

2. Install the brush holder with aligning the peripheries of the yoke and the brush holder.





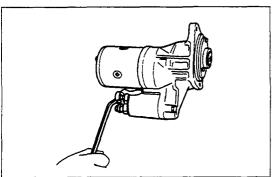
#### 24. Through Bolt

Install the through bolts in the rear cover and tighten them to the specified torque.

Through E	Bolt Torque
-----------	-------------

kg·m(lb·ft/N·m)

$$0.6 \pm 0.1 \ (1.6 \pm 0.3/5.9 \pm 1.0)$$





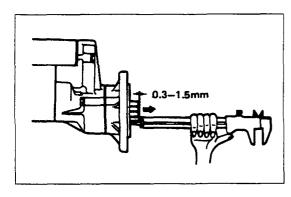
#### 25. Lead Wire

Connect the lead wire in the magnetic switch and tighten the terminal nut to the specified torque.

Lead Wire Terminal Nut Torque

kg·m(lb·ft/N.m)

$$0.9 \pm 0.1 (2.5 \pm 0.3/8.8 \pm 1.0)$$





#### **Inspection After Assembly**

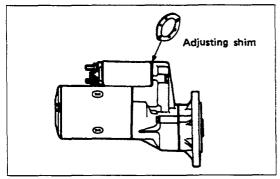
Use a vernier calliper to measure the pinion shaft thrust play.

The pinion shaft thrust play is equal to the pinion shaft end and pinion stopper clearance.

Pinion Shaft Thrust Play

mm(in)

$$0.3 - 1.5(0.01 - 0.06)$$





# In a case where the pinion gap is outside the specified value;

Make an adjustment using a shim(s).

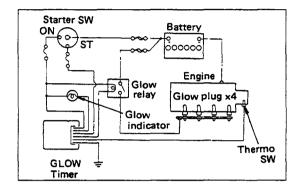
Adjusting shims are available in 0.5 mm and 0.8 mm (0.02 and 0.03 in.) sizes.

#### PRE-HEATING SYSTEM



# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs and part replacement if excessive wear or damage is discovered during inspection.

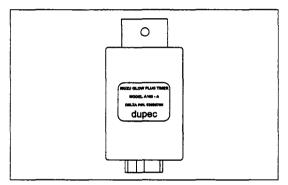


#### SYSTEM CIRCUIT

#### **Visual Check**

Check the main fuses and the glow indicator for damage.

Replace the part(s) if required.



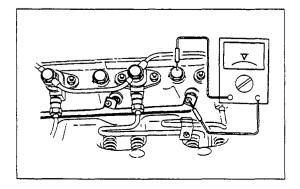
#### **GLOW TIMER**

The glow timer is initially activated by the starter switch.

Thereafter, signals from the thermoswitch reach the glow timer to control the glow plug relay operation time.

The thermoswitch and timer unit also act to protect the battery in the event the starter key is engaged for an excessively long time.

Terminal No.	Circuit Routing
1	Starter switch "ON"
2	Thermoswitch
3	Thermoswitch
4	Starter switch "ST"
5	Glow relay
6	Ground
7	Glow indicator



#### **Glow Timer Operation**

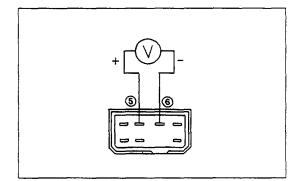
- Disconnect the lead wires at the thermoswitch.
- 2. Connect a voltmeter between the glow plug and ground.
- Turn the starter switch from "OFF to "ON".The engine must be stopped.

4. Note the time the glow indicator remains on.

If the glow indicator remains on for approximately 15 seconds (conventional pre-heating model) or 3.5 seconds (Quick pre-heating model), the glow timer "ON" time is normal.

If the glow indicator does not remain on for approximately 15 seconds or 3.5 seconds, trouble in the glow timer or, the glow relay, is indicated.

5. Return the starter switch to "OFF".



#### **Glow Timer Output**

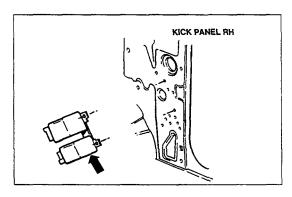
- 1. Disconnect the lead wire at the starter switch.
- 2. Connect the positive lead of the voltmeter to glow timer terminal No. 5.
- 3. Connect the negative lead of the voltmeter to glow timer terminal No. 6.

Do not disturb the other connections.

- 4. Turn the starter switch from "OFF" to "ON".
- 5. Note the voltmeter reading.

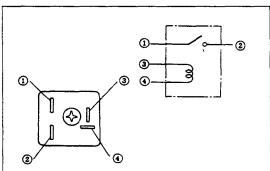
If the voltmeter reading remains at zero for approximately 18 seconds before rising, the glow timer "DELAY" time is normal.

6. Return the starter switch to "OFF".



#### **GLOW RELAY**

The glow relay is located on the RH side kick panel in the inside of the vehicle.



Use an ohmmeter to measure the resistance between terminals No. 3 and No. 4.

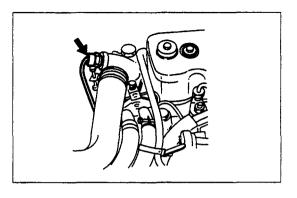
If the measured value is outside the specified range, the glow relay must be replaced.

Glow Relay Resistance

Ohms

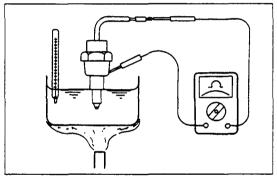
10 - 15

#### **6D-40 ENGINE ELECTRICAL**



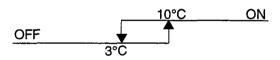


The thermo switch is located on the water outlet pipe.



Use a circuit tester to check the thermo switch for continuity.

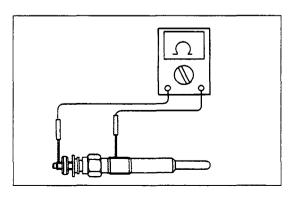
OFF →	ON: 7 – 13°C (45 – 55°F)	
ON →	OFF: Below 3°C (37°F)	





Use a circuit tester to test the glow plugs for continuity.

Glow Plug Resistance (Reference)		Ohms
Conventional model	Approximately 1.5	
Quick on start model	Approximately 0.9	



# TROUBLESHOOTING (For Pre heating system)

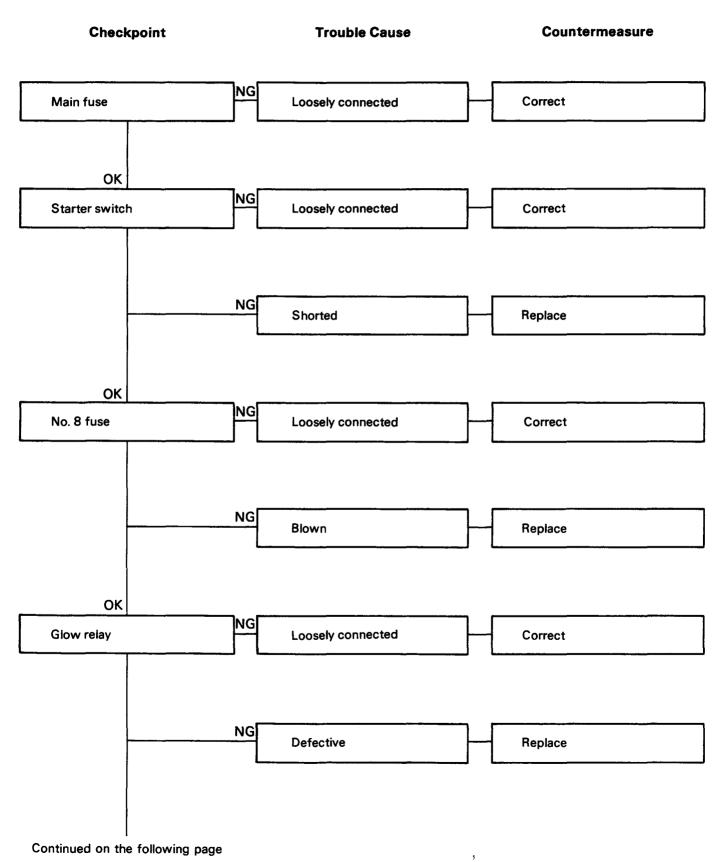
Refer to this Section to quickly diagnose and repair preheating system problems.

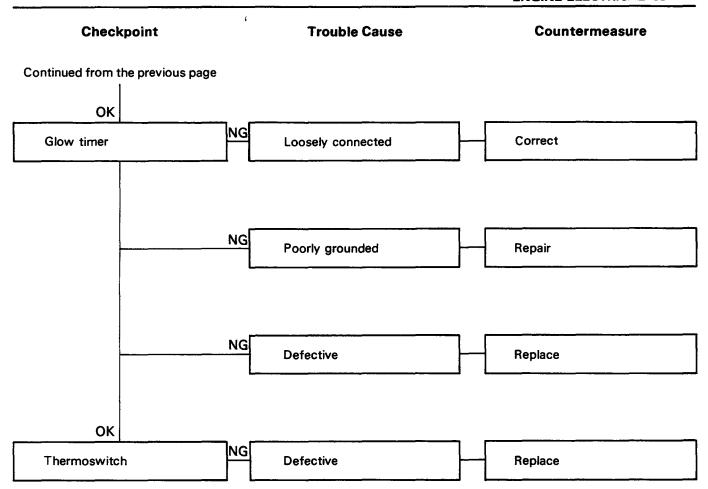
Each troubleshooting chart has three headings arranged from left to right.

- Checkpoint (2) Trouble Cause (3) Countermeasure
- This Section is divided into two Sub-Sections.
  - COOLANT TEMPERATURE 0°C (32°F) OR LESS
    - Glow Relay Does Not Close
    - 2. Glow Relay Closes But Preheating System Does Not Operate
    - 3. Glow Relay Remains Closed
    - 4. Glow Indicator Does Not Light
    - COOLANT TEMPERATURE 0°C (32°F) OR MORE II.
      - 5. Glow Indicator Does Not Light
      - 6 Glow Relay Remains Closed

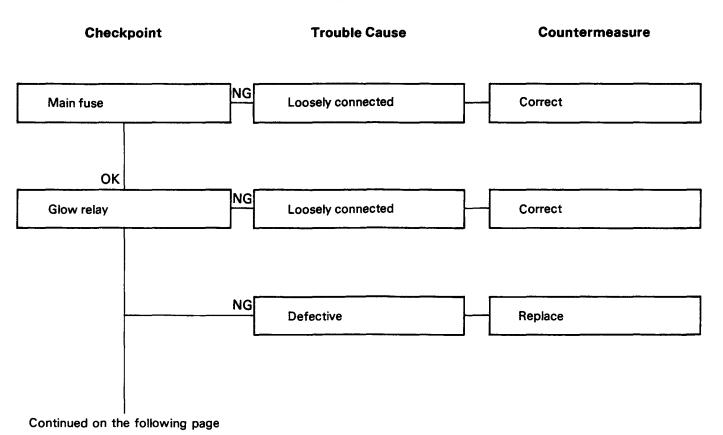
## I. COOLANT TEMPERATURE 0°C (32°F) OR LESS

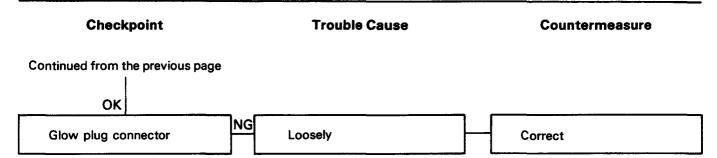
# 1. Glow Relay Does Not Close



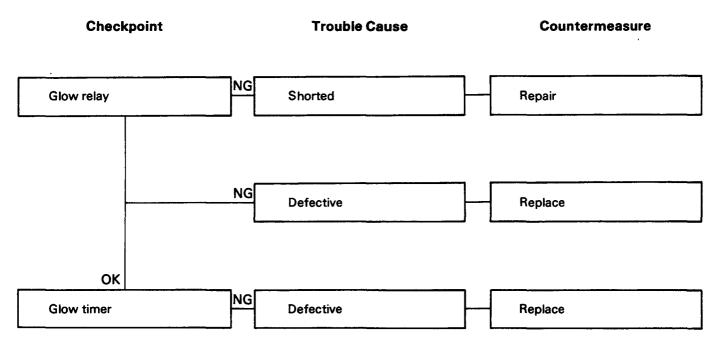


# 2. Glow Relay Closes But Preheating System Does Not Operate

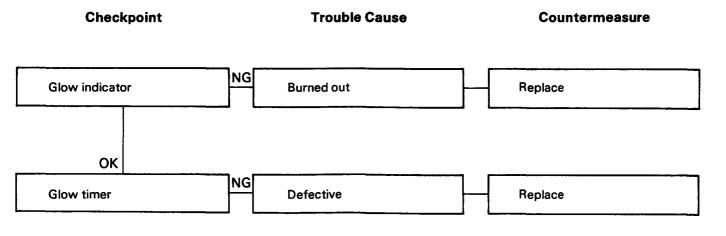




# 3. Glow Relay Remains Closed

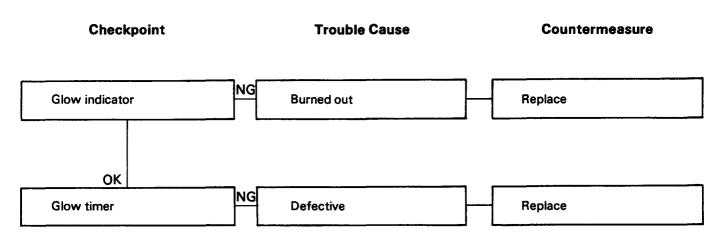


# 4. Glow Indicator Does Not Light

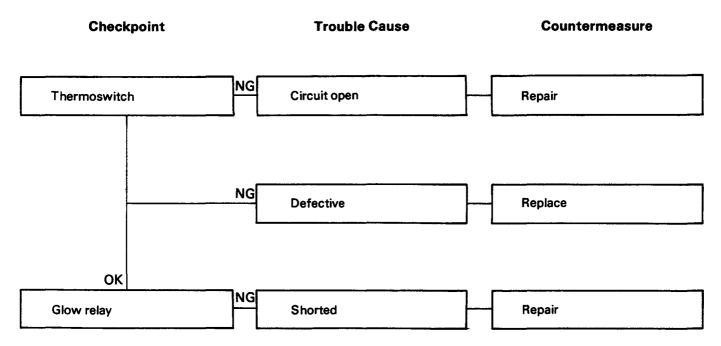


### II. COOLANT TEMPERATURE 0°C (32°F) OR MORE

# 1. Glow Indicator Does Not Light



# 2. Glow Relay Remains Closed



# TROUBLESHOOTING (For Charging and Starting system)

Refer to this Section to quickly diagnose and repair electrical problems.

Each troubleshooting chart has three headings arranged from left to right.

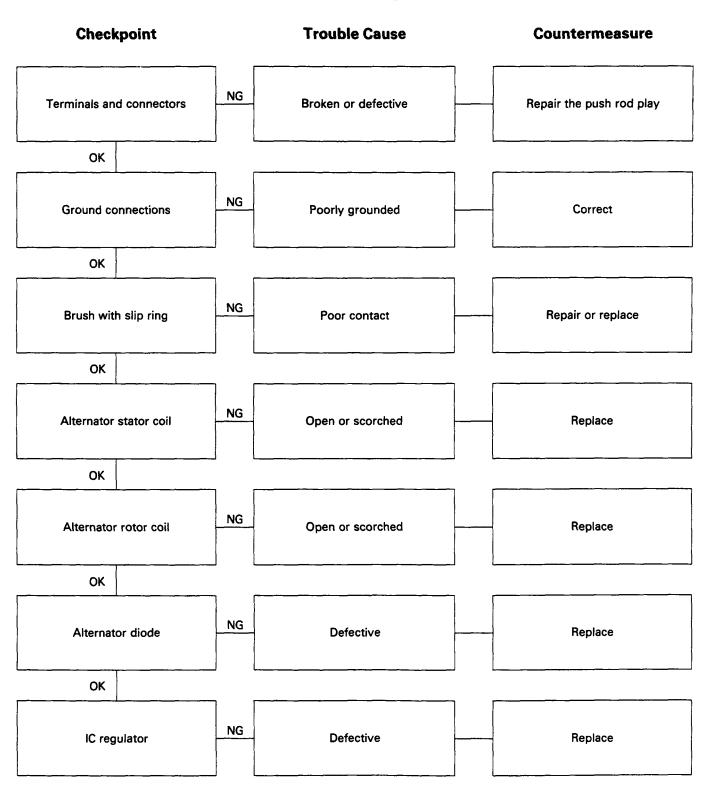
(1) Checkpoint (2) Trouble Cause (3) Countermeasure

This Section is divided into two Sub-Sections:

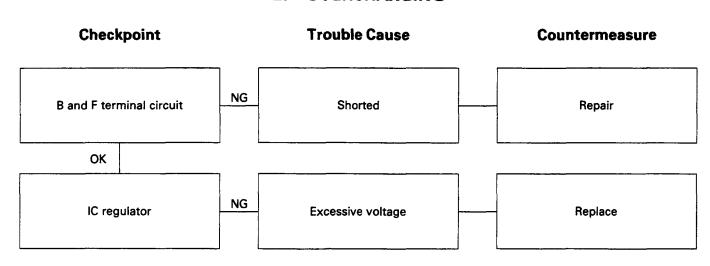
- I. Battery Charging and Noise Problems
  - 1. No Charging
  - 2. Overcharging
  - 3. Undercharging
  - 4. Unstable Charging Current
  - 5. Noise
- II. Hard Starting
  - 1. Pinion Does Not Engage The Ring Gear When The Starter Switch Is Turned On
  - 2. Pinion Engages The Ring Gear But The Engine Does Not Turn Over
  - 3. Incorrect Pinion And Ring Gear Engagement
  - 4. Starter Continues To Run After The Starter Switch Is Turned Off
  - 5. Excessive Commutator Sparking

# I. BATTERY CHARGING AND NOISE PROBLEMS

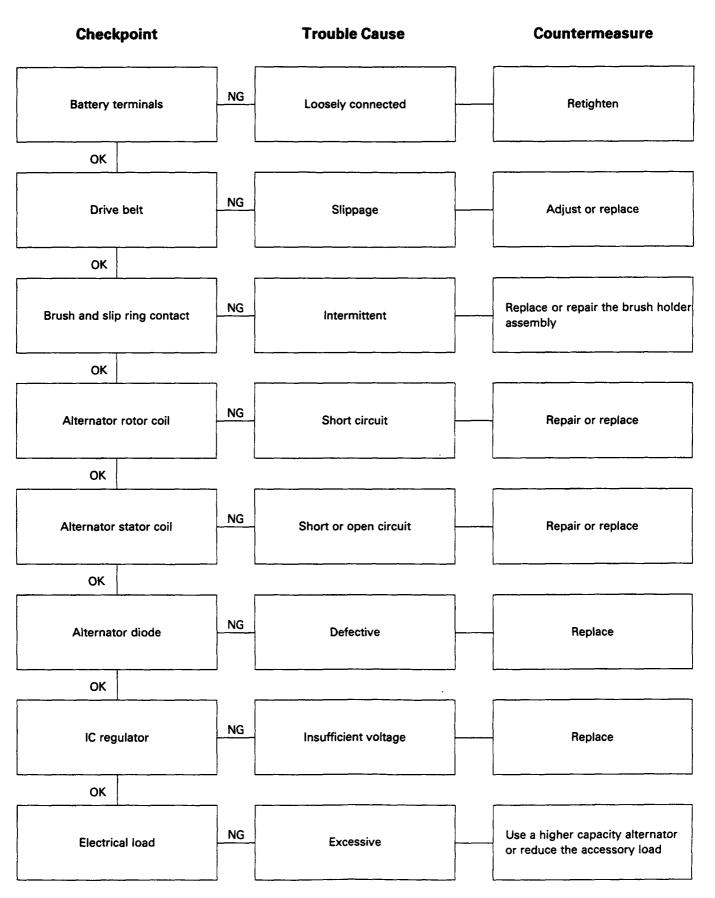
#### 1. NO CHARGING



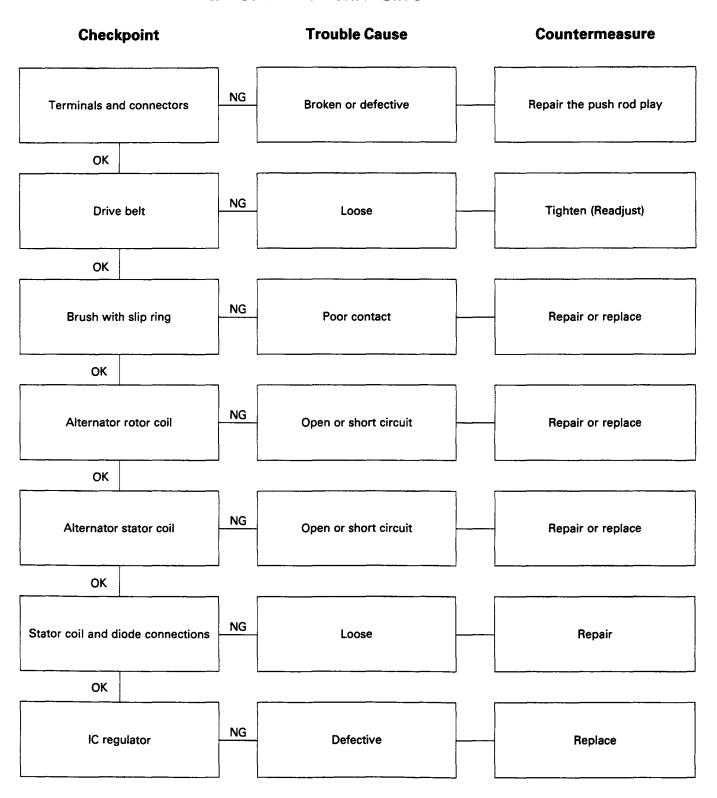
# 2. OVERCHARGING



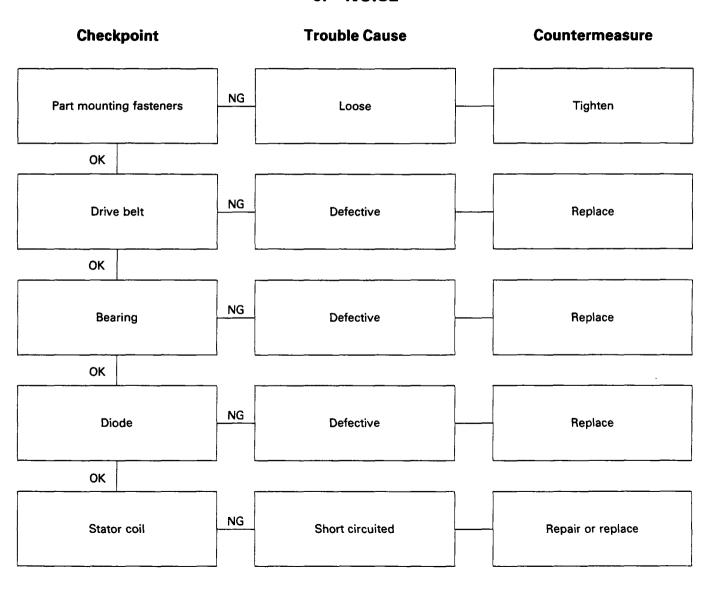
#### 3. UNDERCHARGING



#### 4. UNSTABLE CHARGING CURRENT

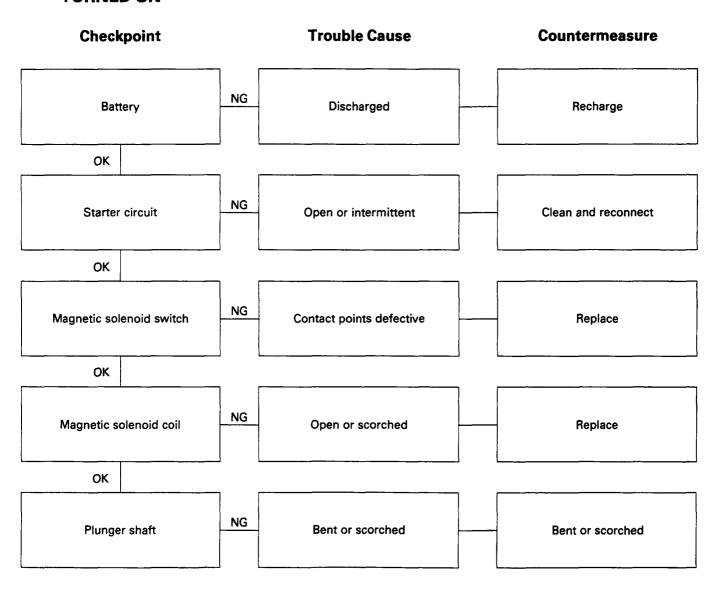


#### 5. NOISE

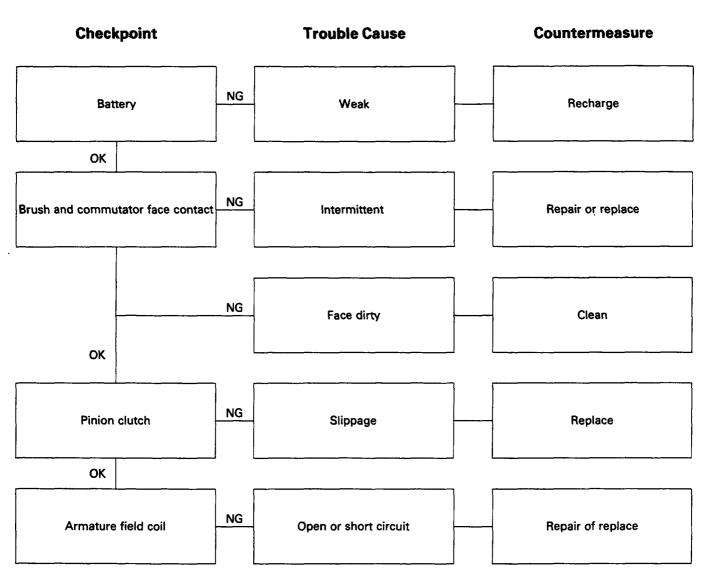


#### II. HARD STARTING

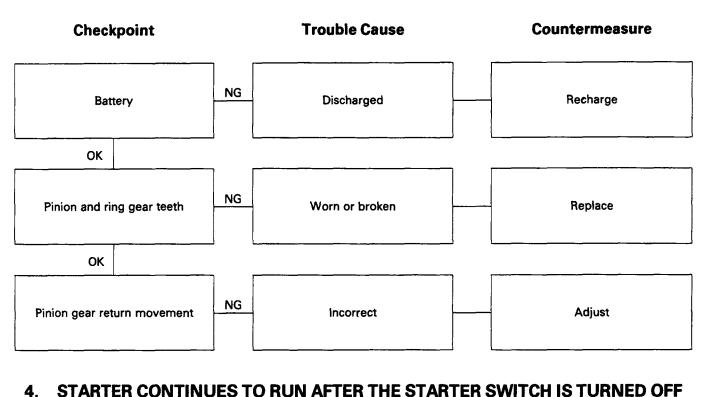
# 1. PINION DOES NOT ENGAGE THE RING GEAR WHEN THE STARTER SWITCH IS TURNED ON



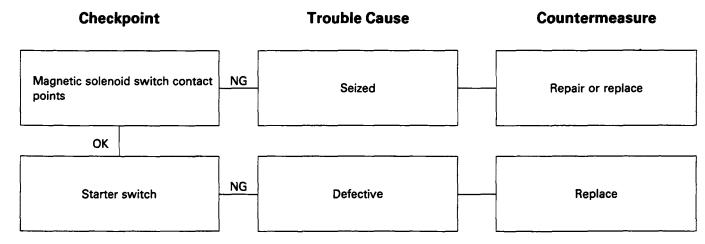
## 2. PINION ENGAGES THE RING GEAR BUT THE ENGINE DOES NOT TURN OVER



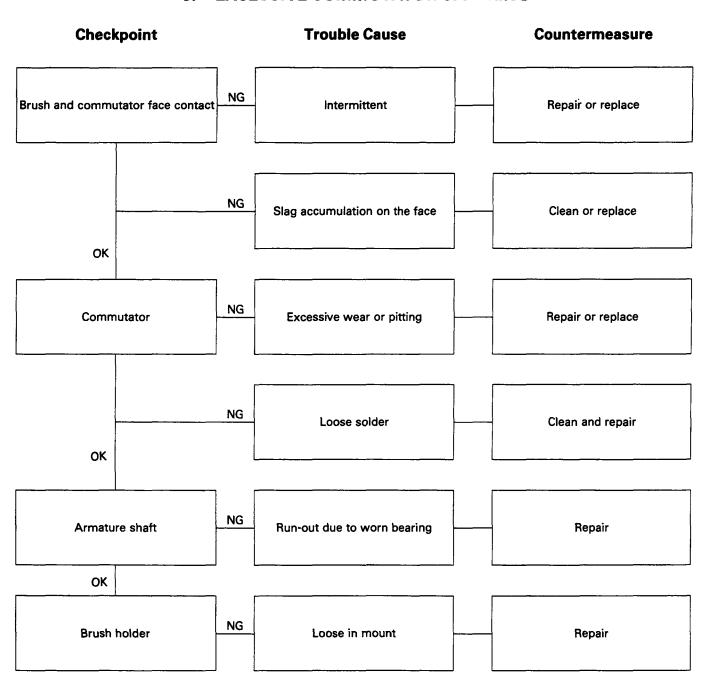
## 3. INCORRECT PINION AND RING GEAR ENGAGEMENT



# 4. STARTER CONTINUES TO ROW AFTER THE STARTER SWITCH IS TURNED OF



#### 5. EXCESSIVE COMMUTATOR SPARKING



# **QOS II PREHEATING SYSTEM**

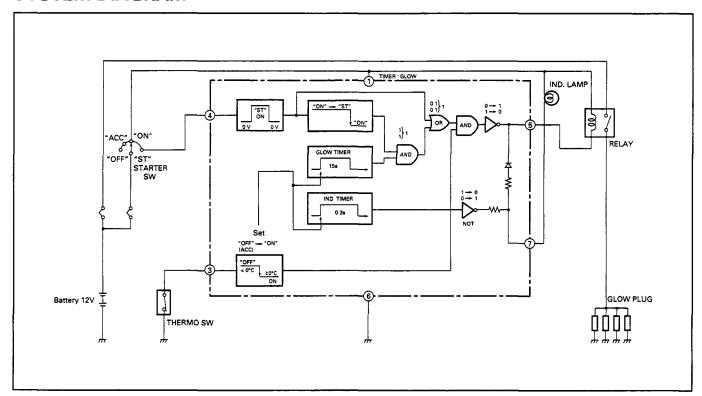
#### **GENERAL DESCRIPTION**

QOS II preheating system features a quick-on glow plug with thermometer control of the glowing time and the afterglow time function.

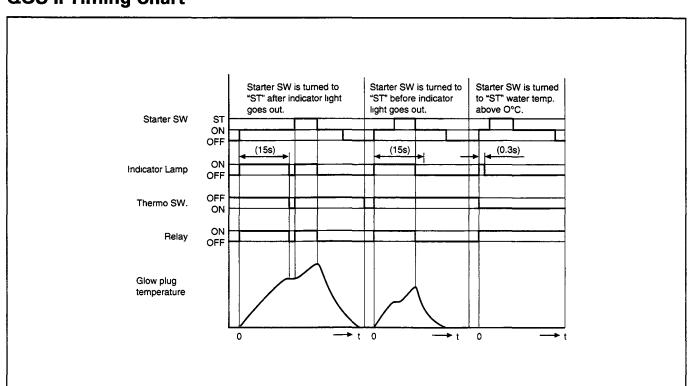
The system consists of a controller, indicator lamp, thermoswitch, relay, and glow plug (4 pcs).

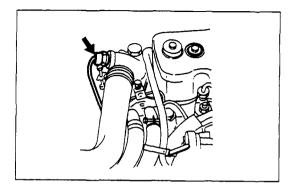
With the employment of the thermoswitch, the glow time changes according to the engine coolant temperature, thus allowing optimum starting conditions to be obtained.

## **SYSTEM DIAGRAM**



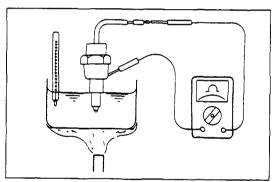
# **QOS II Timing Chart**





# Inspection on QOS II System Operation THERMO SWITCH

The thermo switch is located on the water outlet pipe.



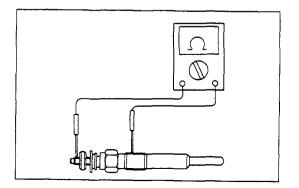
Use a circuit tester to check the thermo switch for continuity.

OFF → ON : 7 – 13°C (44.6 – 55.4°F)

ON → OFF : Below 3°C (37.4°F)

10°C ON

OFF



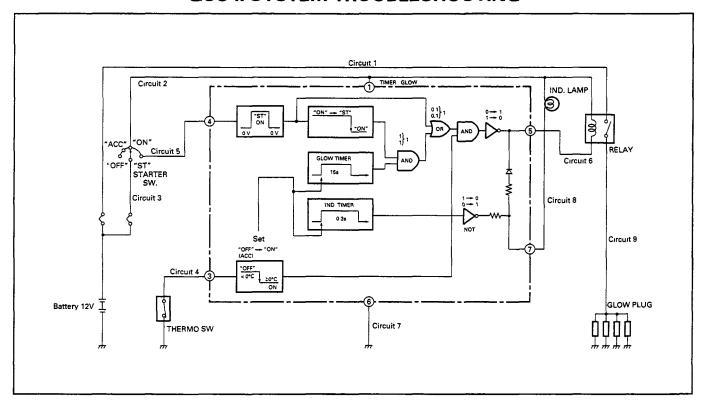
#### **GLOW PLUG**

Glow Plug Recistance / Peterance

Use a circuit tester to test the glow plugs for continuity.

Glow Flag Resistance (Neier	ence Onns
Conventional model	Approximately 1.5
Quick on start model	Approximately 0.9

# **QOS II SYSTEM TROUBLESHOOTING**



1) Problems when the water temperature of the engine is 0°C or below.

Condition	Cause		Circuit
Glow plug relay will not be lit.	Bad connection of FLW between battery and starter.		3
Will Hot bo ht.	Bad connection or disconnection of	f starter SW circuit.	
	Bad connection or disconnection of Fuse No. 8.	Malfunction of other circuits occurred simultaneously.	2
	Bad starter switch.		:
	Bad connection of glow plug relay	terminal.	1
	Disconnection of glow plug relay e	excitation coil.	
	Disconnection of circuit between g	low plug relay and timer.	6
	Bad glow relay. (The main contact	does not pass electricity.)	,
	Bad connection of timer.		
	Bad timer.		
	Bad earth circuit of timer.		7
j	Bad thermoswitch. (It remains ON	even in water temperature below 0°C).	
	Earth short-circuiting of thermo SV	<b>V</b> .	7

#### **6D-60 ENGINE ELECTRICAL**

Condition	Cause	Circuit
Through glow plug relay turns	Bad connection of FLW between battery and glow relay.	1
ON, preheating is not done.	Bad connection or disconnection in preheating circuit of glow relay main contact terminal connector.	
	Bad connection between plug connector and preheating circuit.	9
Glow plug relay turns ON, but	Bad timer.	
does not go OFF.	Bad timer. Short circuiting in circuit or earth between 5 terminal and glow relay.	6
	Bad glow relay.	
Indication lamp	Bad timer.	
is not lit.	Burning-out of light bulb.	8

Note: Circuit No. in rectangle is shown in the previous pre-heating chart.

### 2) Problems when the time water temperature of the engine is 0°C or above.

Condition	Cause	Circuit
Indicator lamp	Bad timer.	
io not ne.	Burning-out of bulb.	8
Turn glow relay ON.	Bad thermoswitch or disconnection of thermo SW circuit. (Indicator will light up for 3.5 seconds.)	4
	Bad timer.	
	Bad timer. Short-circuiting in circuit or earth between terminal 5 and glow relay.	

Note: Circuit No. in rectangle is shown in the previous pre-heating chart.

### 3) Burning-out of glow plug

When only one line is burned out, it has no effect on the start up of the engine. Even if one line is burned out, judging from the characteristics of the glow plug, the impressed voltage will change only slightly. Therefore, no judgement can be made by normal testing while the glow plug is installed. In order to check for disconnections and burn-outs, the glow plugs will have to be removed from the connectors and checked one by one for continuity.







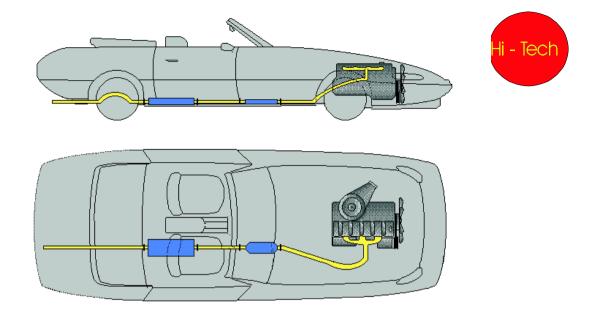




Specs.

Removal

Inspection



# KB TF 140 Diesel Engine Exhaust

# **SECTION 6F**

# **EXHAUST SYSTEM**

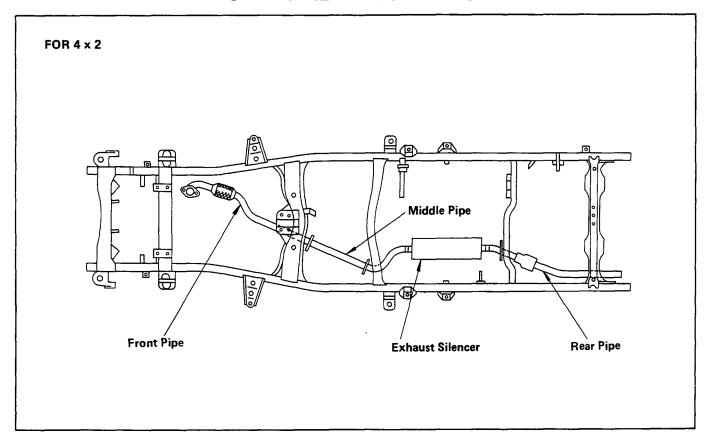
# **TABLE OF CONTENTS**

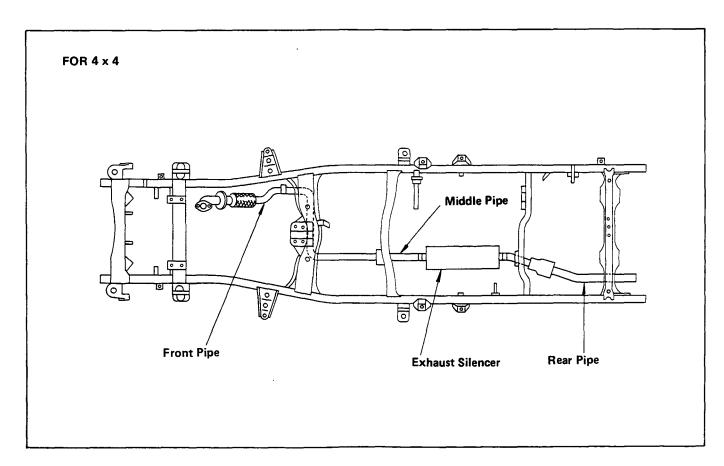
	PAGE
Main Data and Specifications	6F– 2
General Description	6F- 3
Removal and Installation	6F- 4
Inspection and Repair	6F- 6
Turbocharger	6F– 7
Main Data and Specifications	6F- 7
General Description	6 <b>F</b> – 8
Inspection and Repair	6F–10
IHI Service Network	6F–12

# MAIN DATA AND SPECIFICATIONS

Exhaust system		
Pipe outside diameter $ imes$ thickness		
Front pipe	mm(in)	$50.8 \times 1.6 \ (2.0 \times 0.063)$
Middle pipe	mm(in)	$50.8 \times 1.6 \ (2.0 \times 0.063)$
Rear pipe	mm(in)	$50.8 \times 1.6 \ (2.0 \times 0.063)$
Silencer		
Туре		Circular section-shell construction of triple skin and end plates, internal construction of baffles and perforated tubes.
Inside diameter	mm(in)	Approximately 180 (7.1)
Length	mm(in)	Approximately 525 (20.7)
Mounting		
Number of suspension points		5
Type		Rubber and metal

# **GENERAL DESCRIPTION**

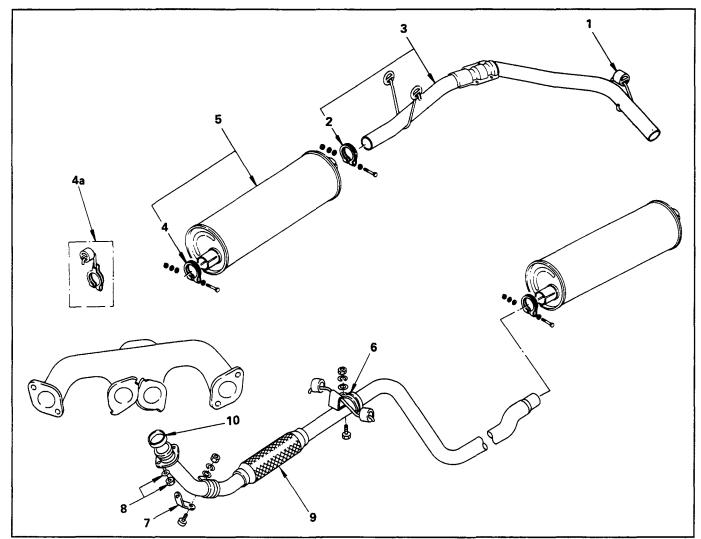








#### **REMOVAL AND INSTALLATION**



#### **Removal Steps**

- 1. Rear hanger clamp
- 2. Silencer rear clamp
- 3. Rear exhaust pipe
- 4. Silencer front clamp
- 4a. Silencer front clamp (For long wheel base)
- 5. Exhaust silencer
- 6. Front hanger clamp
- 7. Exhaust front bracket
- 8. Exhaust pipe nut and washer
- 9. Front exhaust pipe
- 10. Exhaust pipe gasket

#### Installation Steps

- 10. Exhaust pipe gasket
  - 9. Front exhaust pipe
- ▲ 8. Exhaust pipe nut and washer
  - 7. Exhaust front bracket
  - 6. Front hanger clamp
- ▲ 5. Exhaust silencer
  - 4. Silencer front clamp
  - 4a. Silencer front clamp (For long wheel base)
  - 3. Rear exhaust pipe
  - 2. Silencer rear clamp
  - 1. Rear hanger clamp



#### Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

#### 8. Exhaust Pipe Nut and Washer

Connect the exhaust pipe to the exhaust manifold.

Torque	kg·m(lb.ft/	N·m <u>)</u>
	6.8 + 0.5 (49 + 3.6/67 + 5)	

#### 5. Exhaust Silencer

Apply muffler sealer to the joining portion of the pipes.



#### INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Front Exhaust Pipe

Rear Exhaust Pipe

**Exhaust Silencer** 

Check the pipes for corrosion, cracking, damage or misalignment and repair as required.

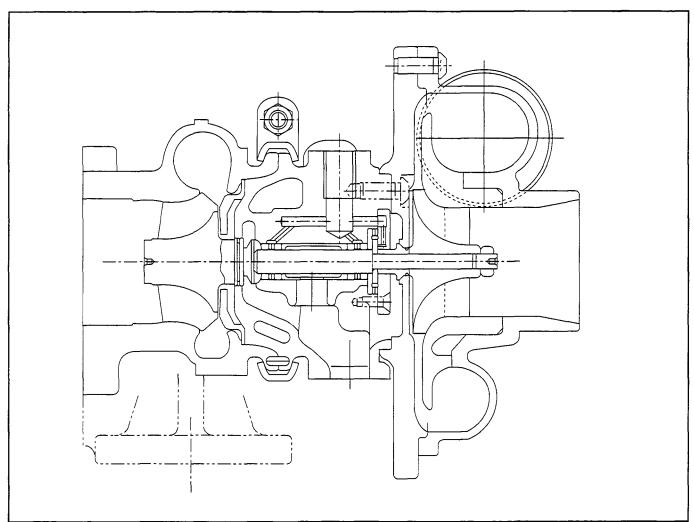
Check the rubber rings for deterioration or damage and repair as required.

# TURBOCHARGER MAIN DATA AND SPECIFICATIONS

	IHI RHF4H	
	Radial-inflow	
	Radial-outflow	
rpm	172,000	
mmHg	757 ± 30	
kg(lb)	4.2 (9.3)	
	mmHg	Radial-inflow Radial-outflow rpm 172,000 mmHg 757 ± 30

IHI: Ishikawajima-Harima Heavy Industries., Ltd.

#### **GENERAL DESCRIPTION**



036LV002

The turbocharger internal mechanism consists of the turbine wheel, the compressor wheel, and the radial brarings. These parts are supported by the bearing housing.

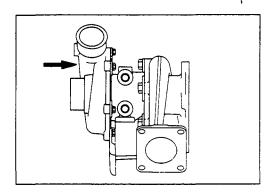
The turbocharger external mechanism consists of the compressor housing air intake port and the turbine housing air exhaust port.

The turbocharger increases air intake efficiency. This results in increased engine power, reduced fuel consumption, and minimal engine noise.

The turbocharger operates at very high speeds and temperatures. Part materials have been carefully selected and machined to extremely high precision.

Turbocharger servicing requires great care and expertise.

If reduced performance is noted, check the engine for damage or wear. If there is no apparent engine damage or wear, trouble with the turbocharger is indicated.



#### **IDENTIFICATION OF UNIT**

The turbocharger nameplate gives the date of manufacture and other important information required to identify the unit when service inquiries are made.

Turbo Spec. ①
Serial No. RHF4 ②
Parts No. ③

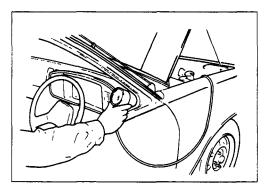
The turbocharger nameplate has the following information stamped on it.

- Turbo Specification Number, Production Year and Month
- ② Production Date, Daily Serial Number
- ③ ISUZU Parts Number



#### **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

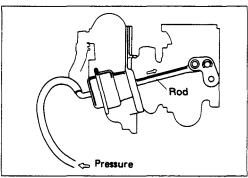




#### Turbocharger pressure check

- (1) Remove the connecting hose from intake pipe.
- (2) Connect the pressure gauge.
- (3) Start the engine and gradually increase the engine speed (the vehicle must be stationary with no load applied to the engine).
- (4) Check to see that turbocharger pressure rises to approximately 300 mmHg.

Pressure Gauge: 5-8840-0075-0



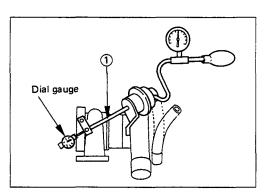


#### Waste gate operation check

- (1) Remove the hose between the waste gate and the intake pipe.
- (2) Connect the pressure gauge.
- (3) Check to see that the rod begins to move when a pressure of approximately 665 mmHg is applied to the waste gate.

#### Note:

Do not apply a pressure greater than 1 kg/cm<sup>2</sup> to the wastegate during this check.





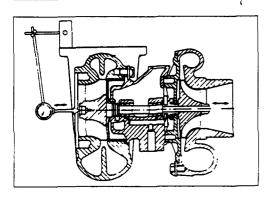
#### Unit Inspection (Remove Turbo. from engine)

Check to see the pressure required to move the control rod 2 mm is within the limits shown below.

Control Rod Operating Pressure	757 mmHg

Contact the "ISUZU MOTORS LIMITED" Dealer service department or "IHI SERVICE FACILITY" for major repairs and maintenance.

Important wheel shaft end play and bearing clearance standards and limits are included below for your reference.



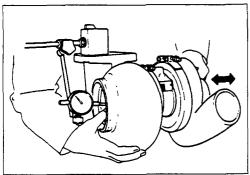


#### Wheel Shaft End Play

Use a dial indicator to measure the wheel shaft end play.

Apply a force of 1.2 kg (2.6 lb/11.8N) alternately to the compressor wheel end and the turbine wheel end.

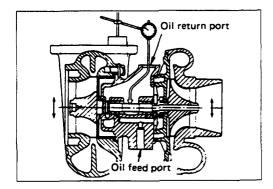
Wheel Shaft End Play	mm(in)	
Standard	Limit	
0.03 — 0.06 (0.001 — 0.002)	0.09 (0.004)	

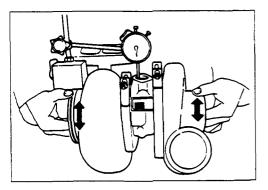




Use a dial indicator to measure the wheel shaft and bearing clearance.

Wheel Shaft and Bearing Clear	ance mm(in
Standard	Limit
0.056 — 0.127 (0.0022 — 0.0050)	0.127 (0.0050)





# ISUZU<br/>KB - SERIES

## **WORKSHOP MANUAL**

**SECTION 6** 

PETROL ENGINE DIAGNOSIS

# SECTION 6 TROUBLESHOOTING

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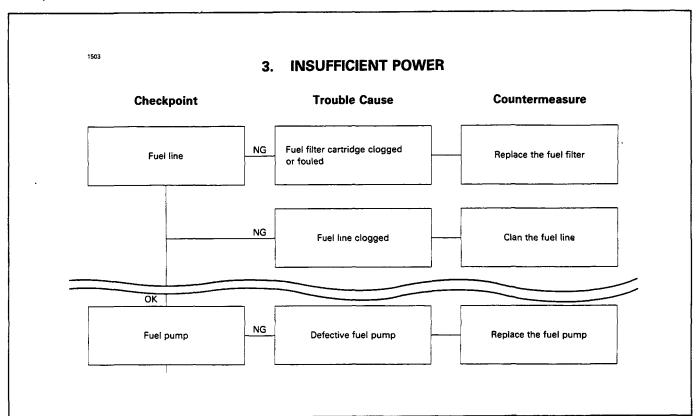
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9.	Abnormal Engine Noise 6-2
10.	Flat Spot 6-27

#### 6-2 TROUBLESHOOTING

Refer to the following troubleshooting charts to quickly pinpoint and repair engine problems.

- This Section is divided into ten Sub-Sections.
- 2. Each troubleshooting chart has three headings arranged from left to right.

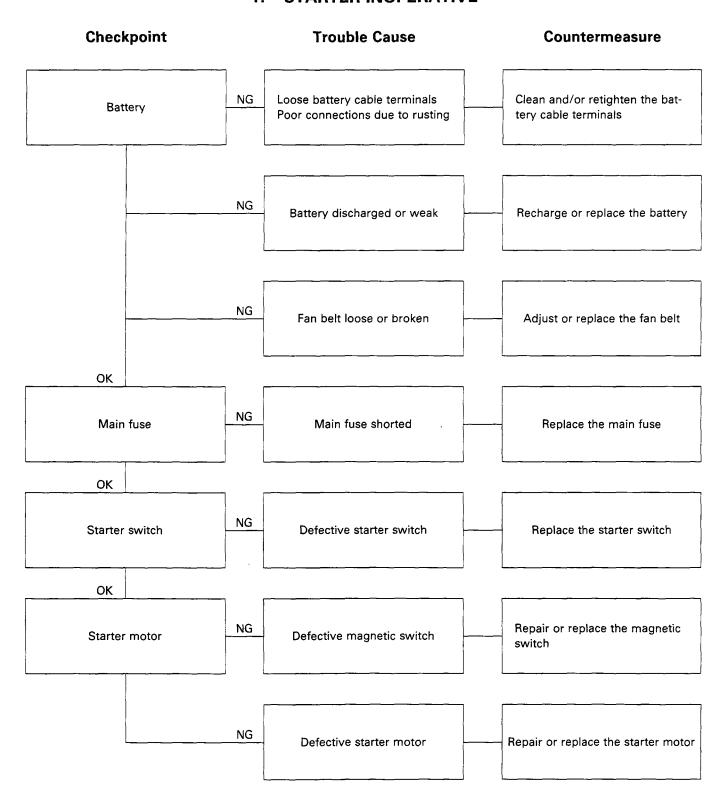
#### Example:



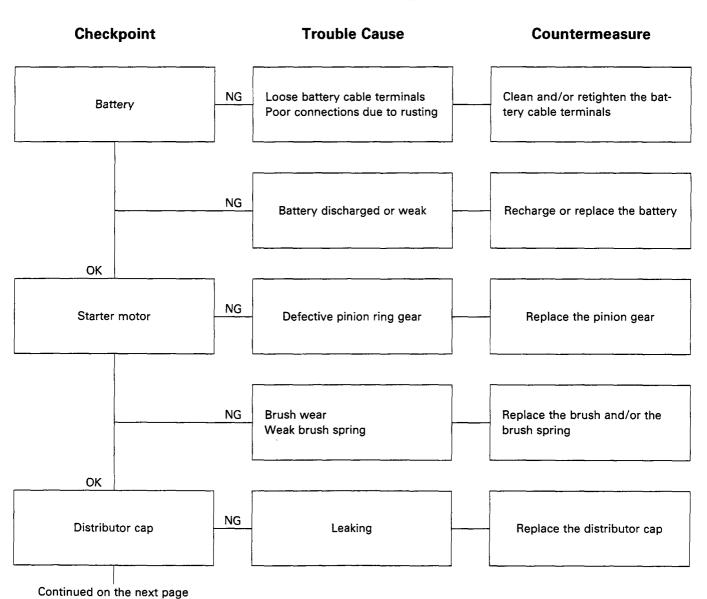
- 3. Easily checked areas are presented at the beginning of the troubleshooting chart. Procedures become more complex as the chart progresses.
- 4 It is suggested that you work from the beginning of the troubleshooting chart. Do not start from the middle.
- 5. It is possible that a seemingly apparent engine problem is not related to the engine.
  - For example, the engine may appear to have insufficient power. This could be caused by dragging brakes or a slipping clutch instead of an engine malfunction.
  - Refer to the other troubleshooting charts if required.
- 6. Optional equipment and variations are included in the troubleshooting charts.
  - If the vehicle you are servicing is not equipped with a particular option or variation noted in the "Checkpoint" frame, disregard the frame and move on to the next one.

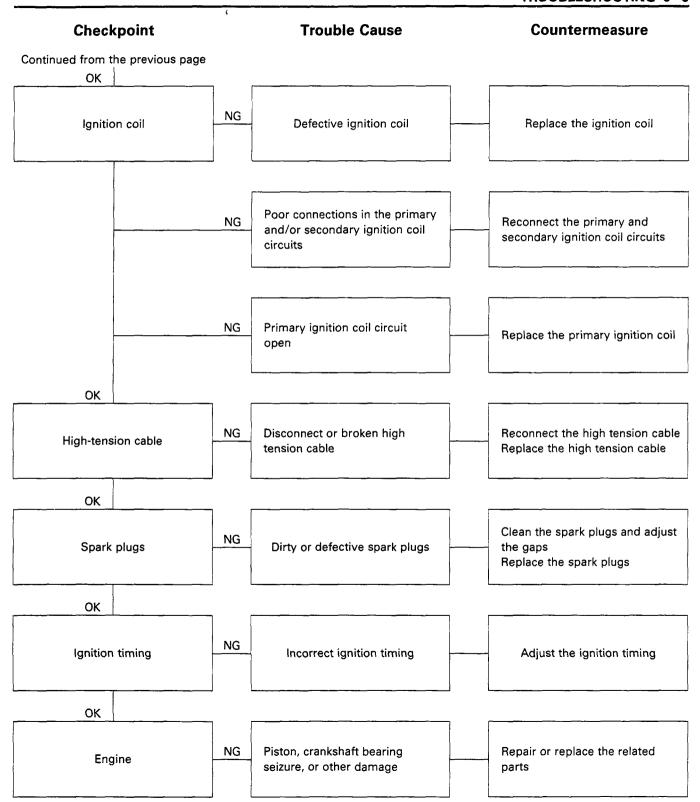
150101

# 1. HARD STARTING 1. STARTER INOPERATIVE

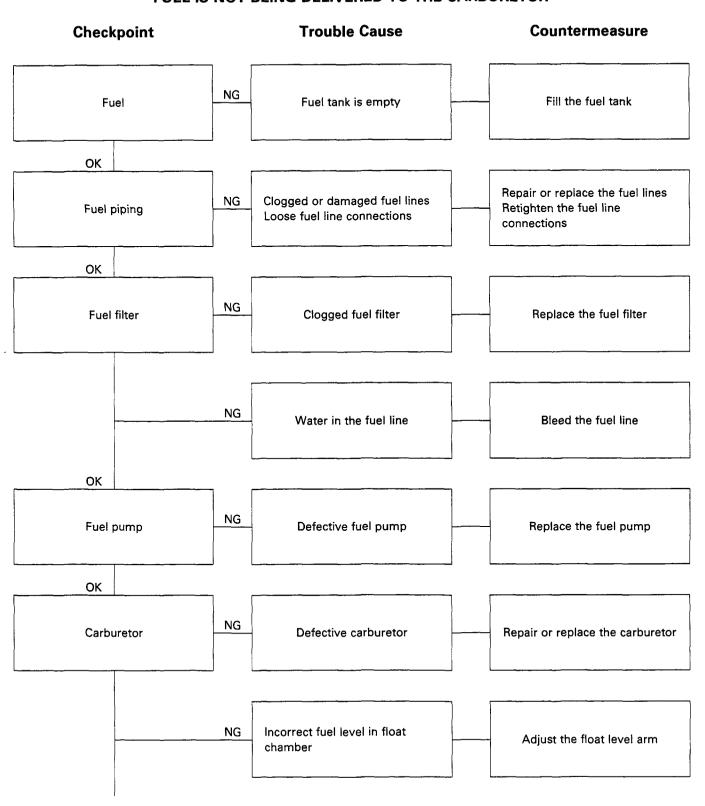


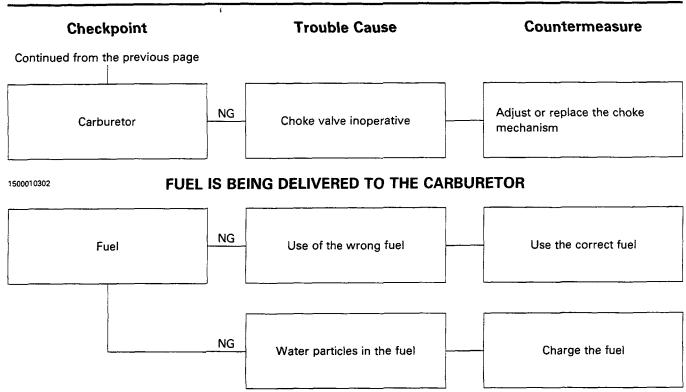
#### 2. STARTER MOTOR OPERATES BUT ENGINE DOES NOT TURN OVER



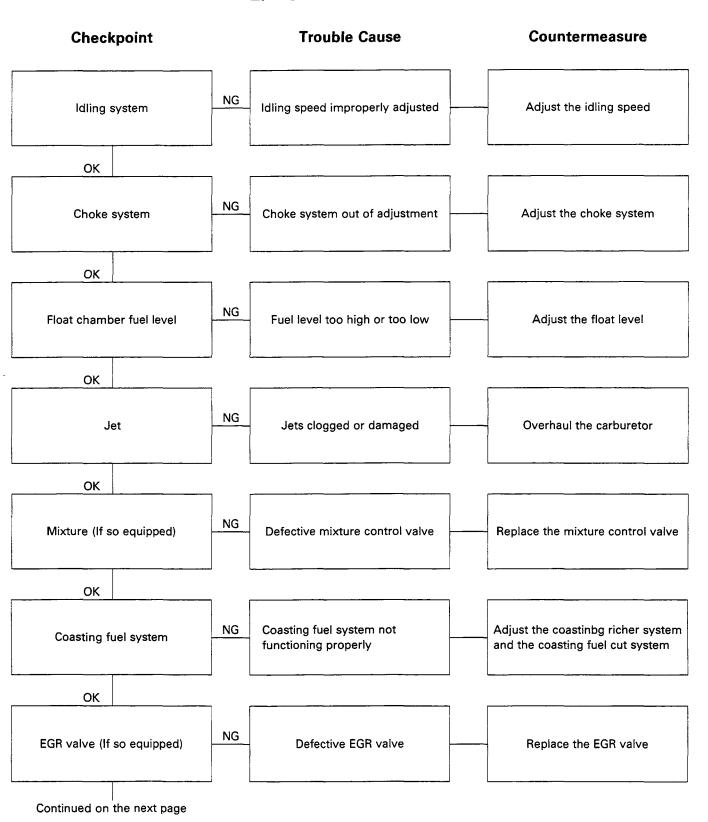


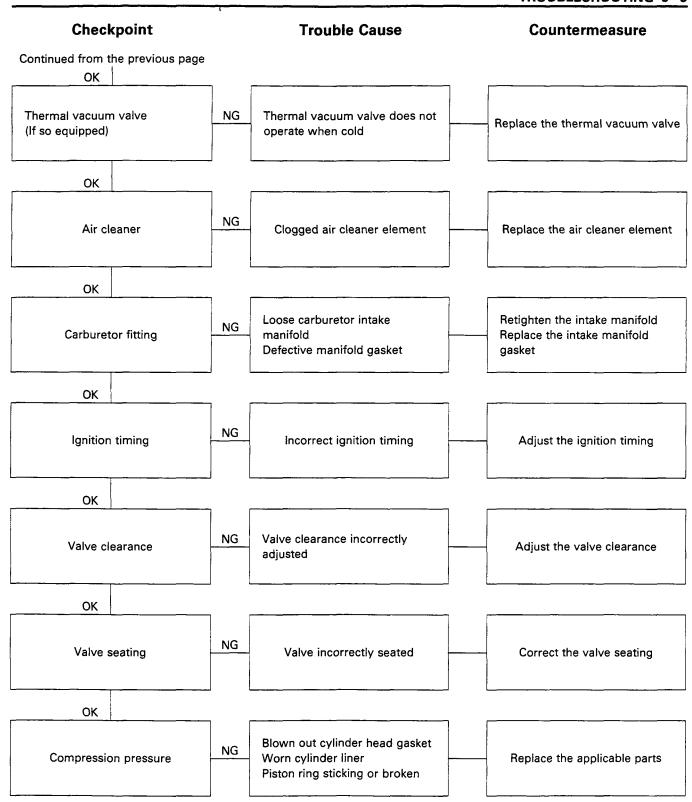
# B. ENGINE TURNS OVER BUT DOES NOT START FUEL IS NOT BEING DELIVERED TO THE CARBURETOR



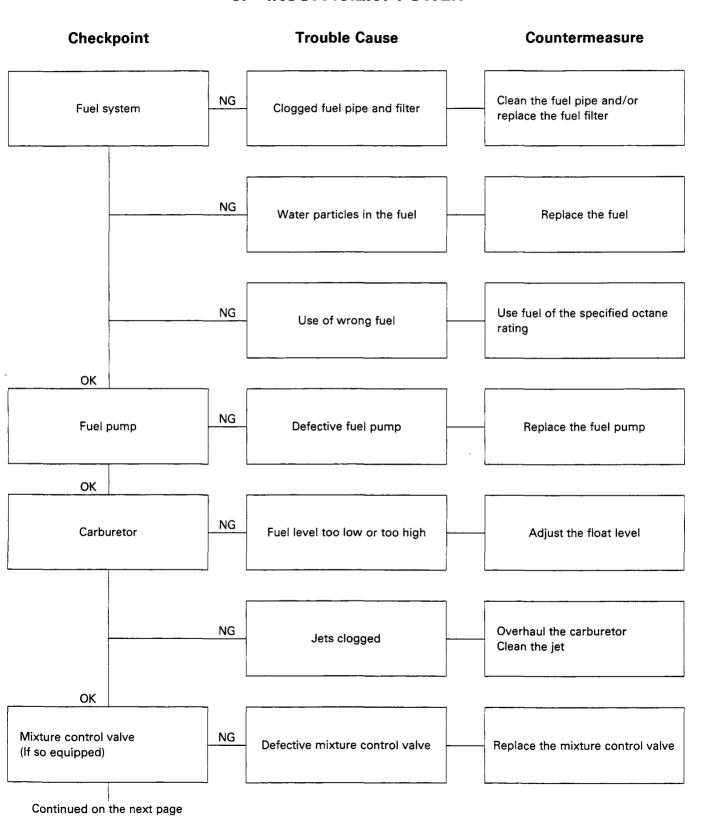


#### 2. UNSTABLE IDLING





#### 3. INSUFFICIENT POWER

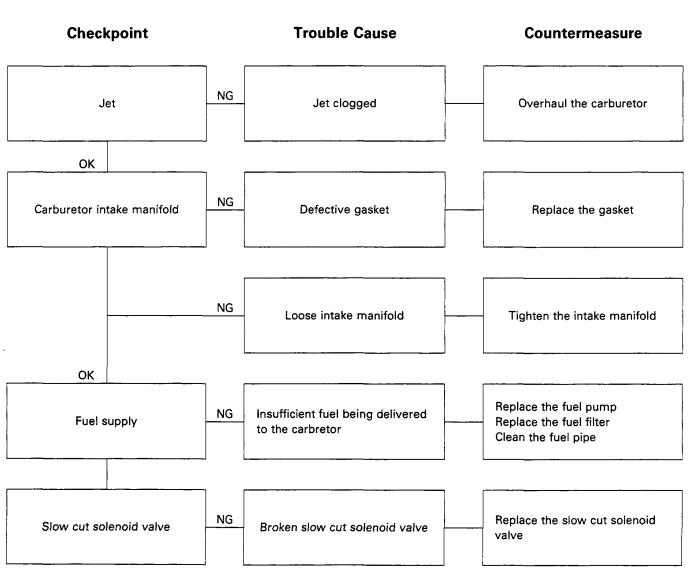


Checkpoint	;	Trouble Cause	Countermeasure
Continued from the prev	ious page		
Air vent valve	NG	Defective air vent solenoid valve	Replace the air vent solenoid Valve
OK			
Fuel tank	NG	Fuel pump not breathing suffi- ciently due to clogged evaporative emission control circuit	Clean the fuel tank
ОК			
Air cleaner	NG	Clogged air cleaner element	Replace or clean the air cleaner element
ок			
Carburetor fitting and	gasket	Loose carburetor fitting Defective gasket	Replace the carburetor gasket Retighten the carburetor
ОК			
Air intake hose	NG	Kinked or flattened air intake hose	Straighten or replace the air intake hose
ОК			
Spark plug	NG	Dirty spark plug Spark plug heat range inadequate	Clean or replace the spark plug Install spark plugs having an adequate heat range
ОК			
Ignition timing	NG	Incorrect ignition timing	Adjust the ignition timing

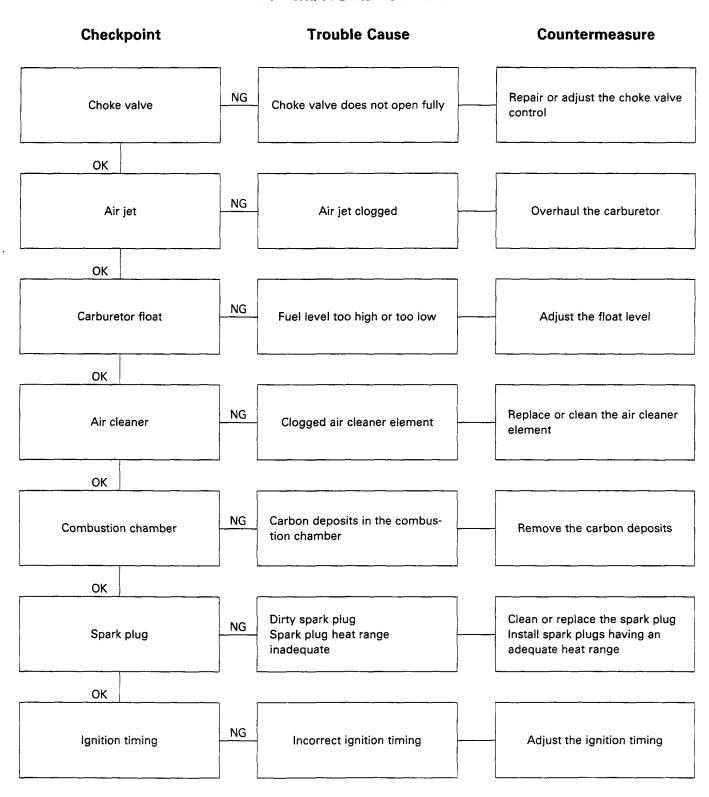
150401

### 4. ABNORMAL COMBUSTION

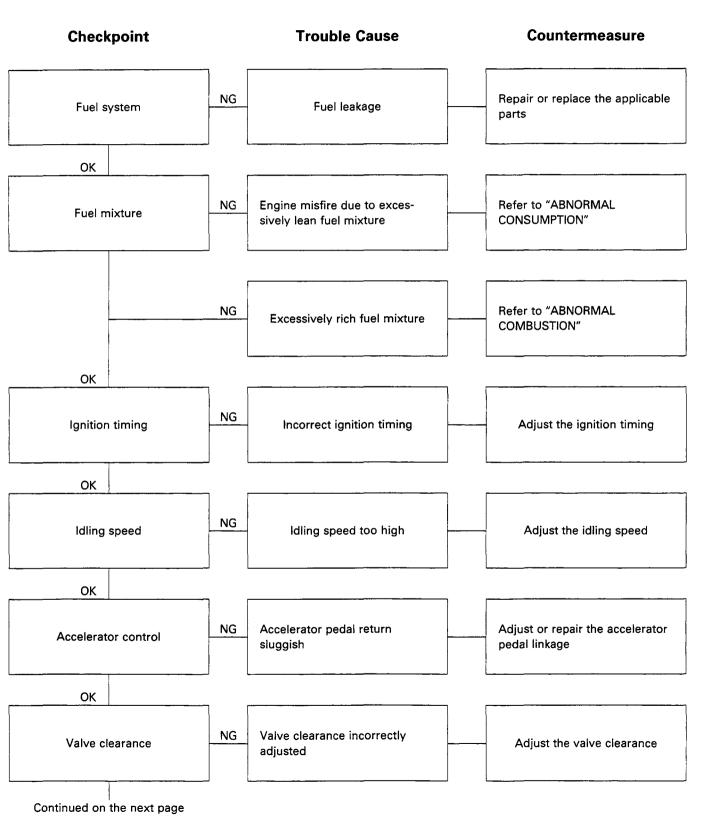
#### 1. MIXTURE TOO LEAN

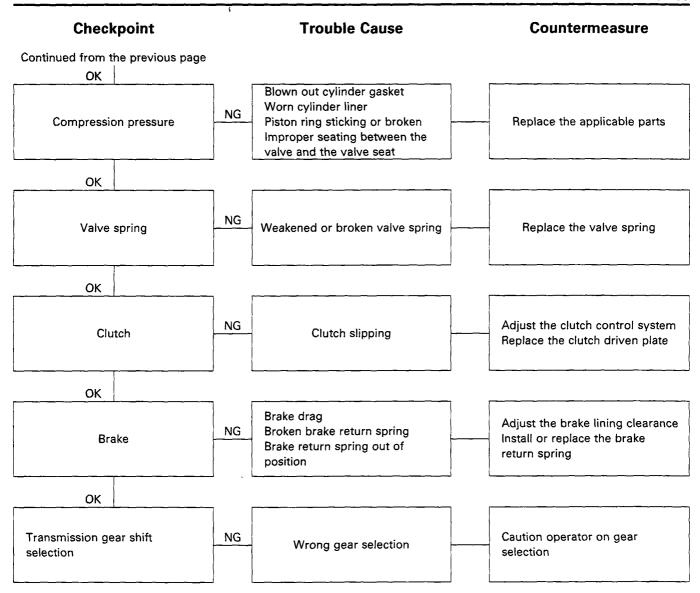


#### 2. MIXTURE TOO RICH

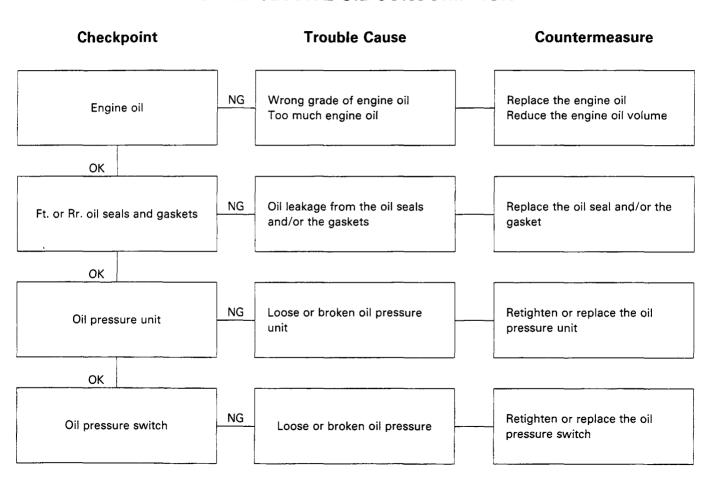


#### 5. EXCESSIVE FUEL CONSUMPTION

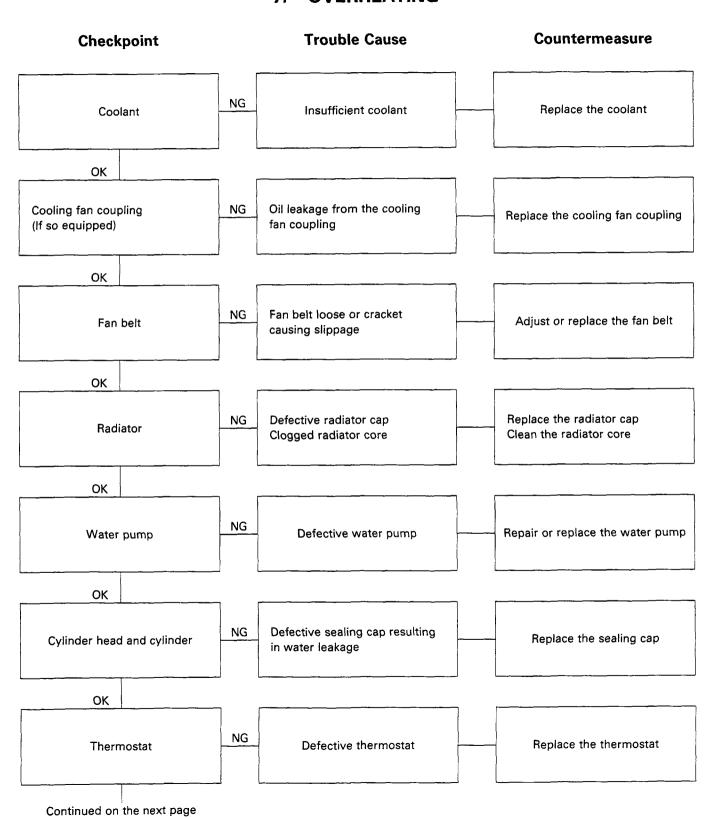


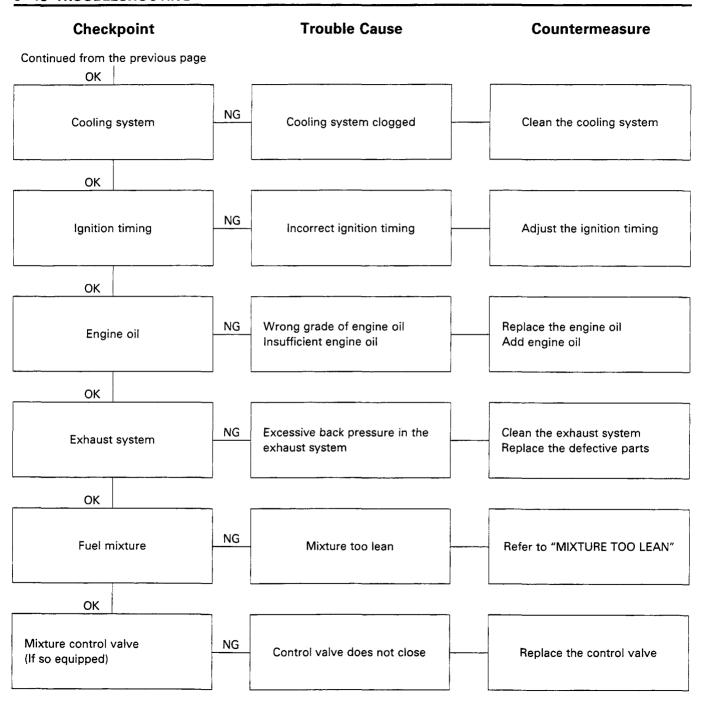


#### 6. EXCESSIVE OIL CONSUMPTION

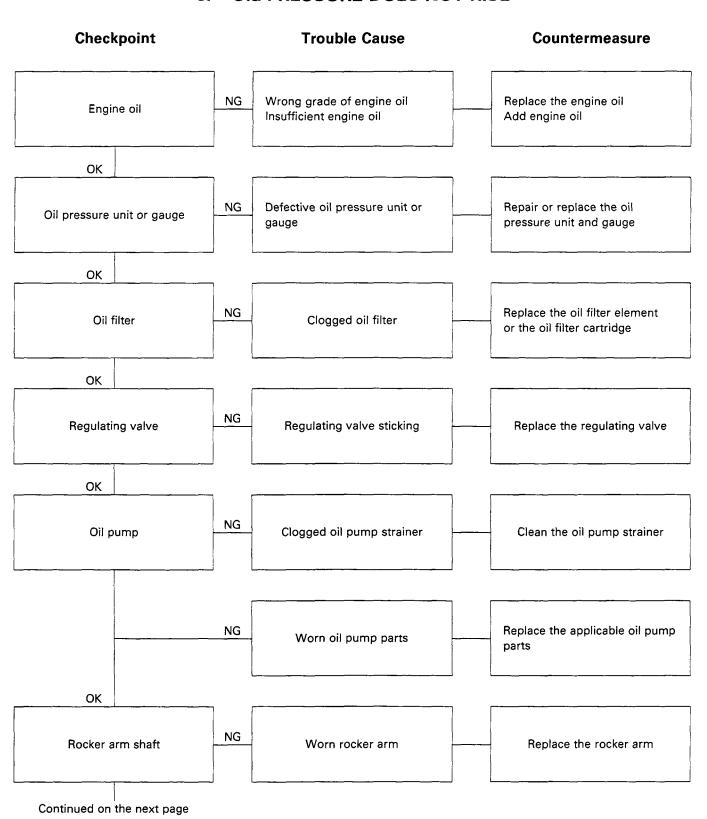


#### 7. OVERHEATING

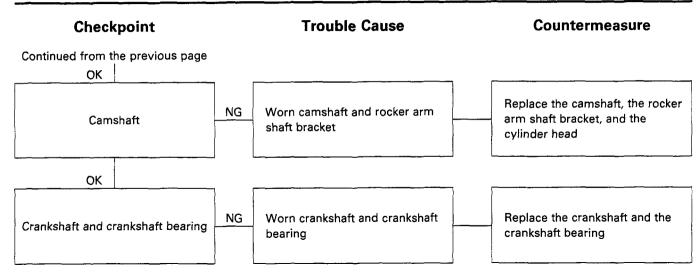




#### 8. OIL PRESSURE DOES NOT RISE



#### 6-20 TROUBLESHOOTING



150901

#### 9. ABNORMAL ENGINE NOISE

#### 1. ENGINE KNOCKING

Checkpoint	Trouble Cause		Countermeasure
Allow the engine to warm up before	beginn	ing the troubleshooting procedure.	
Fuel	NG	Octane rating too low	Replace the fuel
ОК	_		
Ignition timing	NG	Incorrect ignition timing	Adjust the ignition timing
ОК	_		
Spark plug	NG	Spark plug heat range inadequate ——	Install spark plugs having an adequate heat range
OK	_		
Compression pressure	NG	Broken piston ring Blown out head gasket	Replace the head gasket and/or the piston ring along with the related parts
OK	_		
Combustion chamber	NG	Carbon deposits in the combustion chamber	Remove the carbon deposits

Checkpoint

150902

#### 2. GAS LEAKAGE NOISE

**Trouble Cause** 

Countermeasure

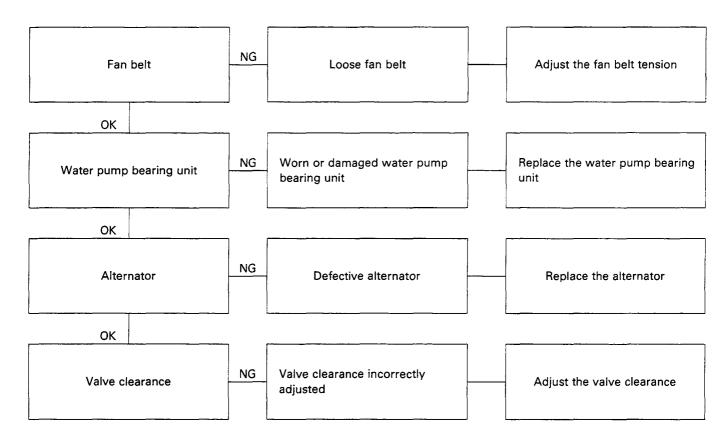
Allow the engine to warm up before beginning the troubleshooting procedure. Tighten the exhaust pipe NG Loosely connected exhaust pipe Exhaust pipe connection Broken exhaust pipe Replace the exhaust pipe OK Loosely connected exhaust Tighten the exhaust manifold NG Exhaust manifold manifold connection Tighten the spark plug Loose spark plug OK NG Cylinder head gasket Damaged cylinder head gasket Replace the cylinder head gasket

#### 3. CONTINUOUS NOISE

#### Checkpoint Trouble Cause Countermeasure

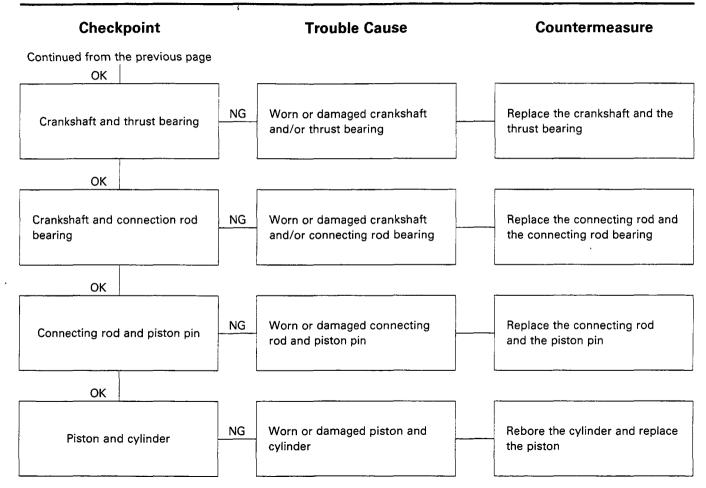
Allow the engine to warm up before beginning the troubleshooting procedure.

٤



#### 4. SLAPPING NOISE

#### Checkpoint **Trouble Cause** Countermeasure Allow the engine to warm up before beginning the troubleshooting procedure. NG Valve clearance incorrectly Valve clearance Adjust the valve clearance adjusted OK NG Rocker arm Damaged rocker arm Replace the rocker arm OK NG Replace the valve stem and the Seized valve stem Valve stem and valve guide valve guide OK NG Valve spring Broken valve spring Replace the valve spring OK NG Lap the valve seat Valve seat Incorrect valve seating Replace the velve seat OK NG Rocker arm and camshaft Replace the camshaft and the Worn or pitted contact faces contact faces rocker arm OK NG Flywheel Loose flywheel bolt Retighten the flywheel boit



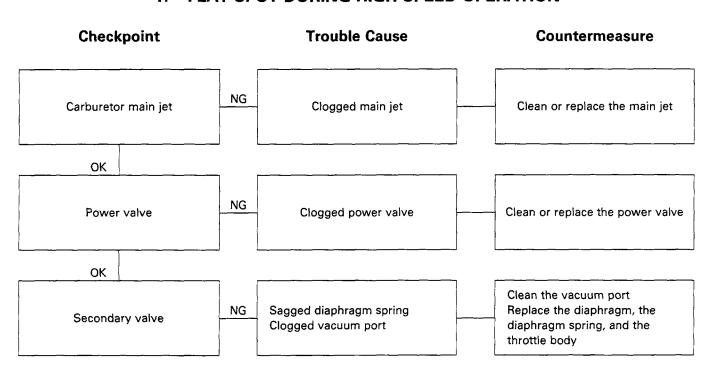
#### 5. OTHER NOISE

#### Checkpoint **Trouble Cause** Countermeasure Allow the engine to warm up before beginning the troubleshooting procedure. NG Defective water pump bearing Replace the bearing unit Water pump unit OK NG Mechanical trouble in the air Replace the air pump Air pump (If so equipped) pump NG Relief valve leakage Replace the relief valve OK NG Air pump drive belt Air pump drive belt slipping Adjust the drive belt tension

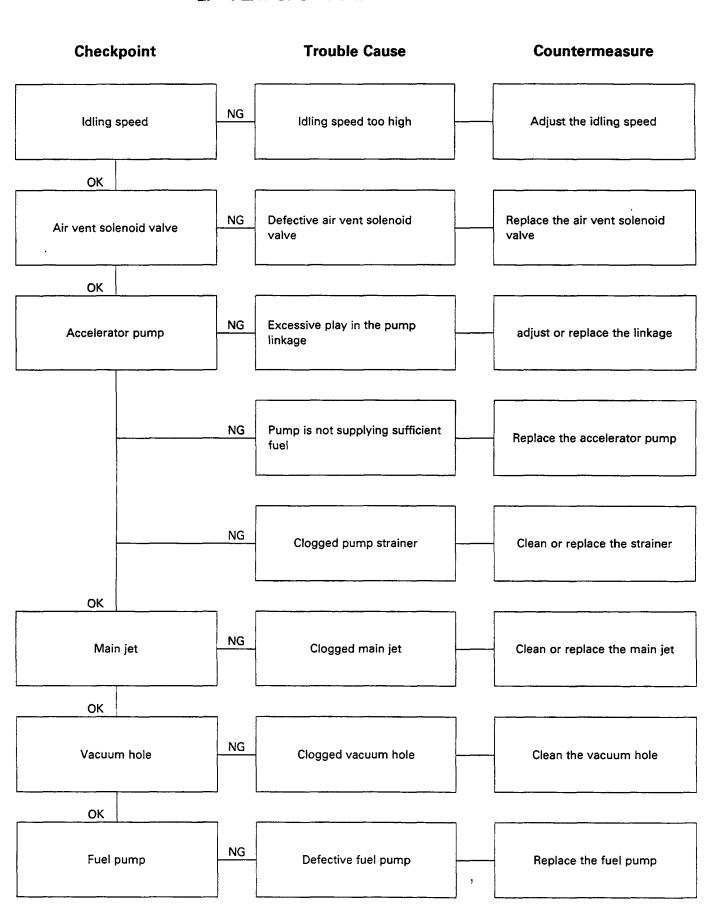
151001

#### 10. FLAT SPOT

#### 1. FLAT SPOT DURING HIGH SPEED OPERATION



# 2. FLAT SPOT DURING ACCELERATION





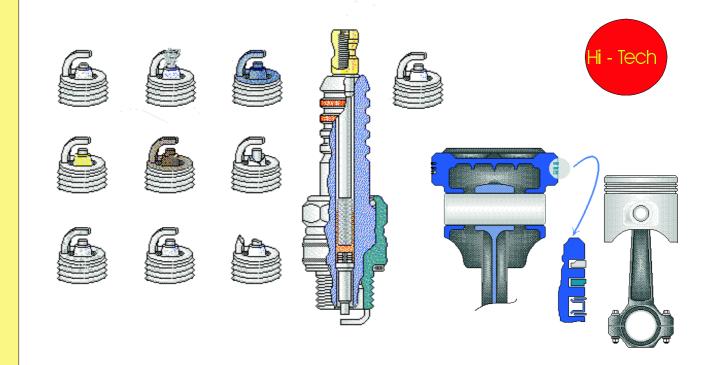
Index

Specs.

Servicing

**Overhaul** 

Lubrication



# KB TF 140 Petrol - Engine



**PAGE** 

# SECTION 6A ENGINE MECHANICAL

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Lubricating System ...... 6A-121

# MAIN DATA AND SPECIFICATIONS (CARBURETTOR TYPE)

Engine model				
Item			4ZC1	4 <b>Z</b> E1
Engine type				ater cooled, crossflow erhead camshaft
Combustion cha	mber type		Hemisp	herical
Timing train syst	em		Belt o	drive
No. of cylinders	- bore x stroke		4-88.0x82.0 (3.46x3.23)	4-92.6x95.0 (3.64x3.74)
No. of piston ring	gs		Compression	rings: 2/Oil ring:1
Total piston displ	lacement	cc(in³)	1,994 (121.7)	2,559 (156.2)
Compression rat	tio (to 1)		8.0	8.3
Compression pre	essure	kg/cm²(psi/kPa)	12 (170.6/1	
Engine weight (	Ory)	kg(lb)	Approx.	Approx.
			135 (297.7)	149 (328.5)
Firing order			1 - 3 -	4 - 2
Ignition timing (E	BTDC)	deg/rpm	10/800	6/800
Idling speed		rpm	800	800
Valve clearance	(At cold) Intake Exhaust	mm(in) mm(in)	0.15 (0 0.25 (0	•
Valve clearance	(At hot) Intake Exhaust	mm(in) mm(in)	0.20 (0 0.30 (0	•
Intake valves	Open at (BTDC) Close at (ABDC)	deg deg	2 6	
Exhauxt valves	Open at (BBDC) Close at (ATDC)	deg deg	5:	
Ignition system			Fully transisto	rized battery ignition
Distributor type Diatributor adv Spark plug typ Spark lug gap	vance type e	mm(in) 0.7	Contract Centrifugal a BPR6ES-11 or BP6ES of 1.0-1.1 (0.040-0.043) for ca (-0.8 (0.028-0.031) Except ca	and vacuum or W20EXR-U or BPR6E talytic conventer vehicle

	(		
	Engine model		
Item		4ZC1	4ZE1
Lubricating system Lubricating method Specified engine oil (API grade) Oil pressure	kg/cm²(psi/kPa)rpm		SF 71.1/392.4-490.5)/4,000 SC grade] engine oil after
Oil pump type		Troch	oid
Oil filter type		Cartridge,	full flow
Oil capacity	lit. (US/UK gal.)	4.9 (1.24, 1.08)	5.5 (1.45, 1.21)
Cooling system Radiator type Coolant capacity	lit. (US/UK gal.)	8.6 92.2, 1.9)	with reserve tank 9.0 (2.3, 2.0)
Water pump type		Centrif	ugal
Thermostat type		Wax pellet with	n jiggle valve
Fuel system Carburetor type Fuel pump type Fuel pressure	kg/cm²(psi/kPa)rpm	Stomberg 2-ba Mecha 0.25 (3.56/24.50) fo 0.24 (3.4/23.5) for NII	nical r HITACHI CARB
Fuel filter type		Cartridge pap	er element
Air cleaner type		Dry paper eler (viscous) pap	nent or Oil wetted er element
Battery Ty	pe/V-A x No. of units	34B19R (12/33) 46B24R (12/45)	50D20R (12/50)
Alternator capacity	V-A(W)	12-55 (	(660)
Starter motor output	V-kW	12-1.0	12-1.2

# **TORQUE SPECIFICATION**



# STANDARD BOLTS

The torque values given in the following table should be applied whenever a particular torque is not specified.

kg·m(lb.ft/N·m) Strength 9.8 (9T) 4.8 (4T) (7T) 8.8 Class Refined Non-Refined **Bolt** Identification **Bolt** No mark **Diameter**× Pitch (mm) M 6 × 1.0  $0.60 \pm 0.20$  $0.75 \pm 0.25$  $(4.33 \pm 1.44/5.88 \pm 1.96)$  $(5.43 \pm 1.80/7.35 \pm 2.45)$ M 8 × 1.25  $1.30 \pm 0.50$ 1.75 + 0.552.40 + 0.70 $(9.40\pm3.62/12.74\pm4.90)$  $(12.66\pm4.00/17.15\pm5.39)$  $(17.36 \pm 5.06/23.52 \pm 6.86)$ M10 × 1.25 2.80 + 0.703.75 + 0.955.10±1.30  $(20.25\pm5.06/27.44\pm6.86)$  $(27.12\pm6.87/36.75\pm9.31)$  $(36.89\pm9.40/49.98\pm12.74)$ M12 × 1.25 6.25 + 1.25775 + 1.55 $9.65 \pm 1.95$  $(45.21\pm9.04/61.25\pm12.25)$  $(56.06 \pm 11.21/75.95 \pm 15.19)$  $(69.80 \pm 14.10/94.57 \pm 19.11)$  $M14 \times 1.5$ 9.75 + 1.95 $11.85 \pm 2.35$ 14.50±2.90  $(70.52 \pm 14.10/95.55 \pm 19.11)$  $(85.71 \pm 17.00/116.13 \pm 23.03)$  $(104.88\pm21.00/142.10\pm28.42)$  $M16 \times 1.5$  $13.30 \pm 2.70$  $17.30 \pm 3.50$ 20.40±4.10  $(96.20\pm19.53/130\ 34\pm26.46)$  $(125.13\pm25.32/169.54\pm34.30)$  $(147.55\pm29.66/199.92\pm40.18)$  $M18 \times 1.5$ 19.20±3.80  $24.90 \pm 5.00$  $29.30 \pm 5.90$  $(138.87 \pm 27.49/188.16 \pm 37.24)$  $(180.10\pm36.17/244.02\pm49.00)$  $(211.93\pm42.67/287.14\pm57.82)$  $M20 \times 1.5$ 26.30±5.30 34 40±6.90 40.40+8.10  $(190.23\pm38.33/257.74\pm51.94)$  $(248.82 \pm 49.41/337.12 \pm 67.62)$  $(292.21 \pm 58.59/395.92 \pm 79.38)$  $M22 \times 1.5$  $33.90 \pm 8.30$ 46.25±9.25  $54.10 \pm 10.80$ (245.20±60.03/332.22±81 34)  $(334.53\pm66.91/453.25\pm90.65)$  $(391.30\pm78.12/530.18\pm105.84)$  $M24 \times 2.0$  $45.80 \pm 9.20$ 58.20±14.30  $70.60 \pm 14.10$  $(331.27 \pm 66.54/448.84 \pm 90.16)$  $(420.96 \pm 103.43/570.36 \pm 140.14)$  $(510.65\pm101.99/691.88\pm138.18)$ \*M10 × 1.5  $2.70 \pm 0.70$  $3.70 \pm 0.90$  $4.90 \pm 1.20$  $(19.53\pm5.06/26.46\pm6.86)$  $(26.76\pm6.50/36.26\pm8.82)$  $(35.44 \pm 8.68/48.02 \pm 11.76)$ \*M12 × 1.5  $5.80 \pm 1.20$  $7.20 \pm 1.40$  $9.10 \pm 1.80$  $(41.95\pm8.68/56.84\pm11.76)$  $(52.08 \pm 10.13/70.56 \pm 13.72)$  $(65.82 \pm 13.02/89.18 \pm 17.64)$ \*M14 × 2.0  $9.10 \pm 1.80$  $11.20 \pm 2.20$  $13.60 \pm 2.70$  $(65.82 \pm 13.02/89.18 \pm 17.64)$  $(81.01 \pm 15.91/109.76 \pm 21.56)$  $(98.37 \pm 19.53/133.28 \pm 26.46)$ \*M16 × 2.0  $12.70 \pm 2.50$ 16.50±3.30  $19.50 \pm 3.90$ 

An asterisk (\*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting. Those shown in parentheses in the strength class indicate the classification by the old standard.

 $(119.34 \pm 23.87/161.70 \pm 32.34)$ 



# **FLARE NUTS**

 $(91.86 \pm 18.08/124 \ 46 \pm 24.50)$ 

kg·m(lb.ft/N·m)

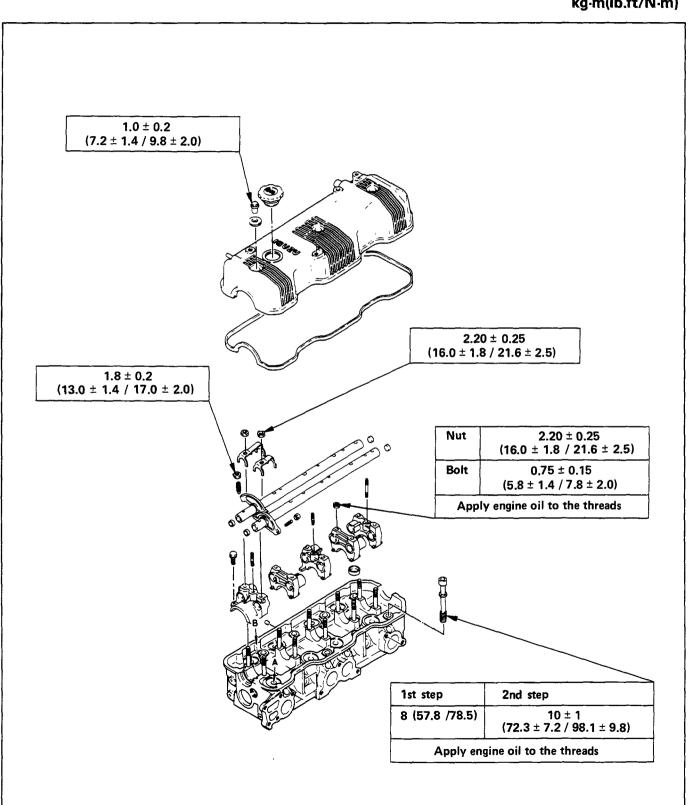
 $(141.04 \pm 28.21/191.10 \pm 38.22)$ 

Pipe diameter mm(in)	Torque	Pipe diameter mm(in)	Torque
4.76 (0.187)	1.55±0.25 (11.2± 1.8/15.2±2.45)	10.00 (0.394)	5.50±0.5 (39.7±3.6/53.95±4.90)
6.35 (0.250)	$2.70\pm0.30~(19.5\pm2.1/26.48\pm2.94)$	12.00 (0.472)	9.00±1.0 (65.0±7.2/88.29±9.80)
8.00 (0.315)	4.50±0.50 (32.5±3.6/44 14±4.90)	15.00 (0.591)	10 75±1 25 (77 7±9.0/105.45±12.26)

# SPECIAL PARTS FIXING NUTS AND BOLTS

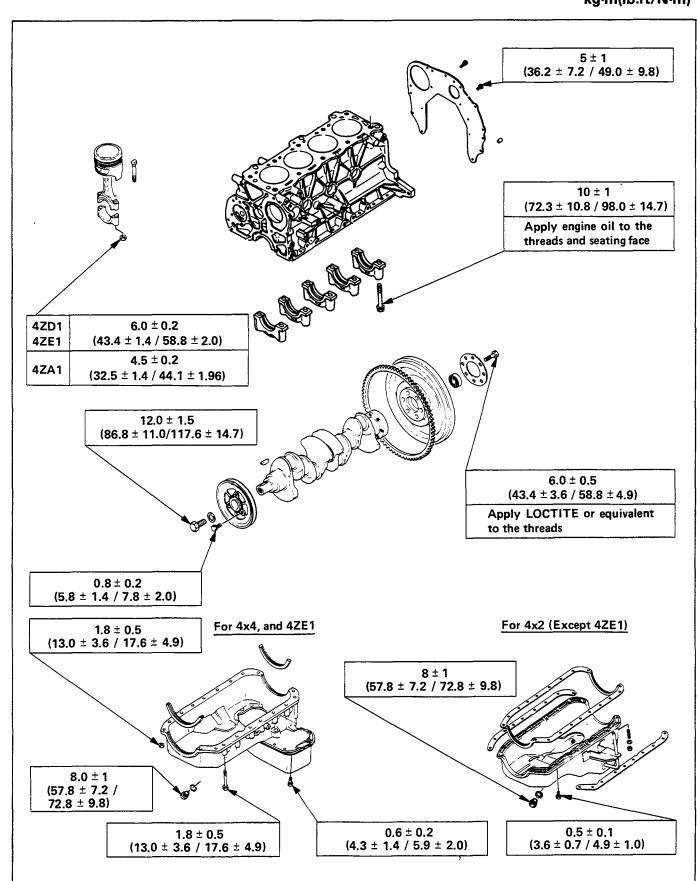
Cylinder Head Cover, Cylinder Head, and Rocker Arm Shaft Bracket

 $kg \cdot m(lb.ft/N \cdot m)$ 

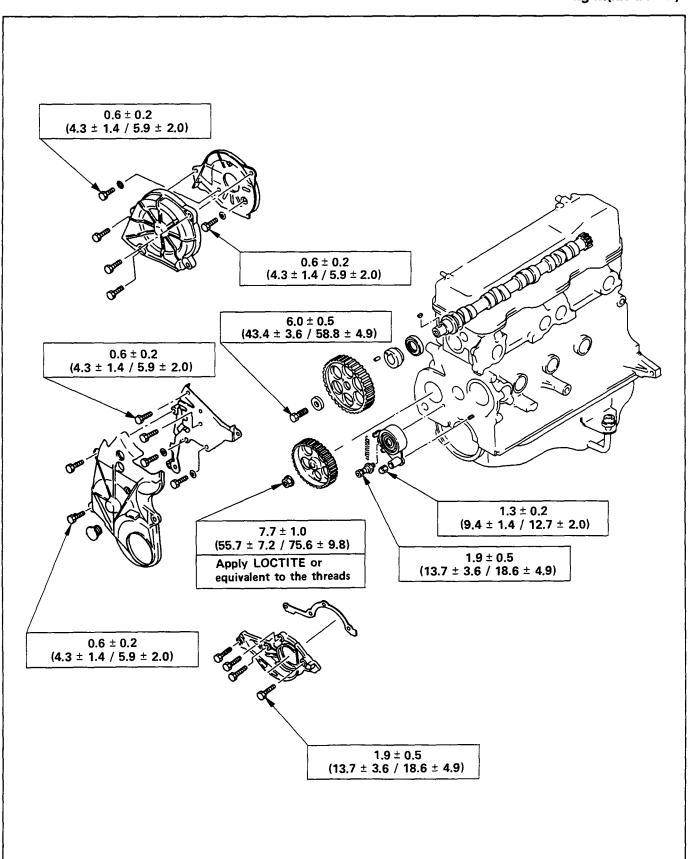


020402

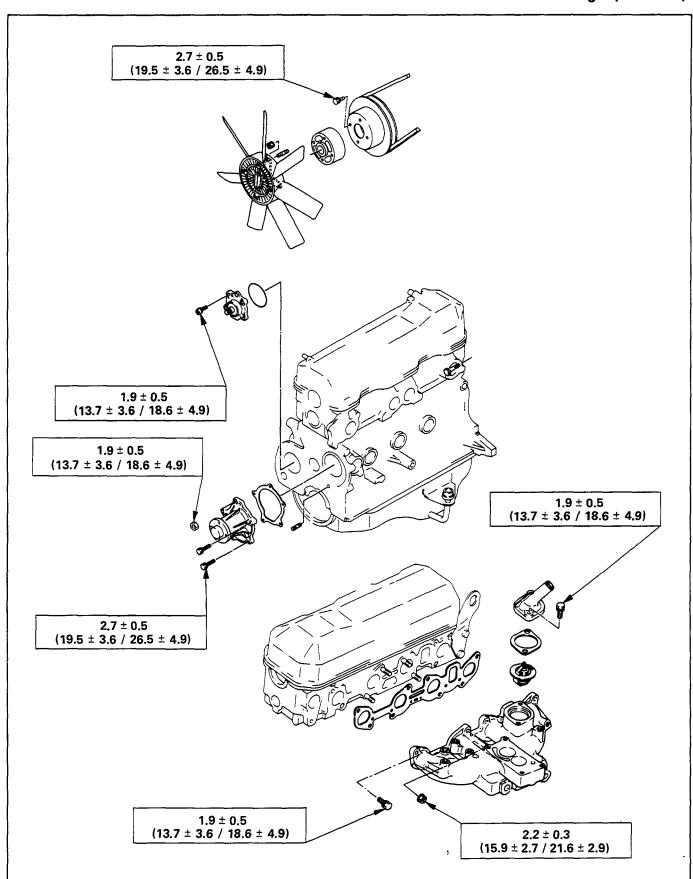
Crankshaft Bearing Cap, Connecting Rod Bearing Cap, Crankshaft Damper Pulley, Flywheel, and Oil Pan



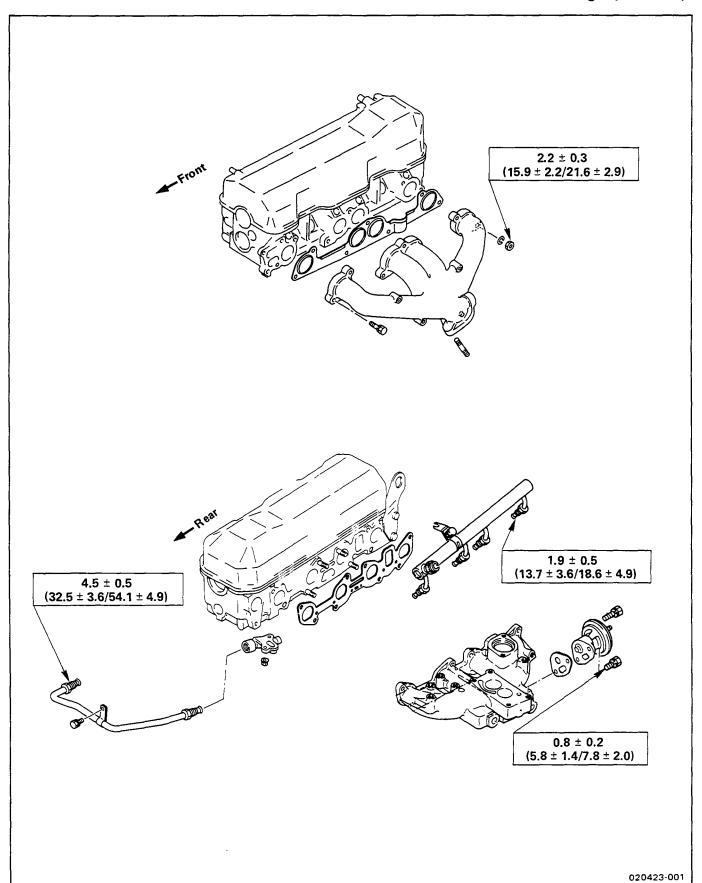
# **Timing Cover, Camshaft, and Timing Pulley**



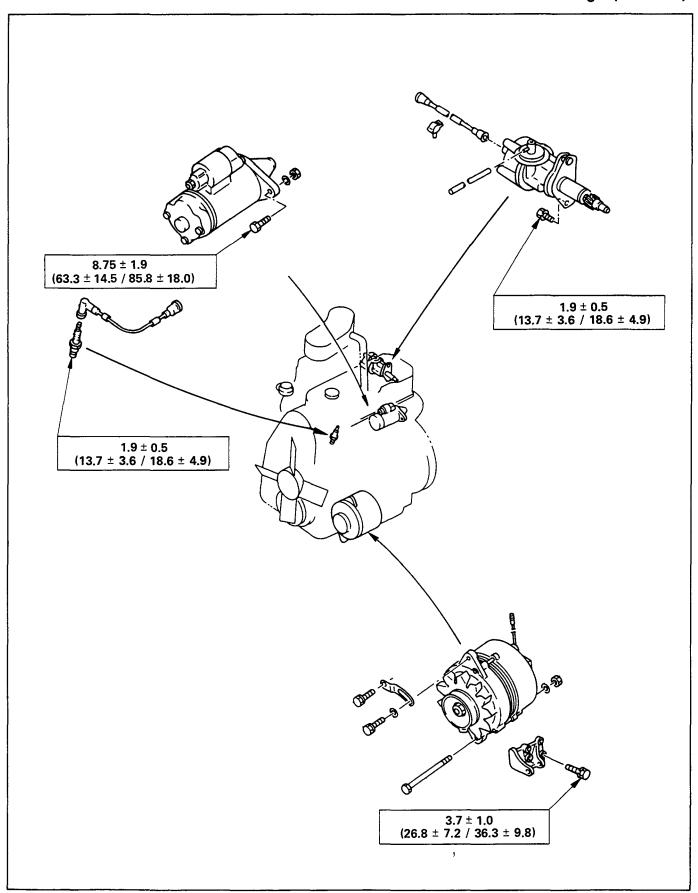
# **Cooling and Lubricating System**



# **Intake and Exhaust System**



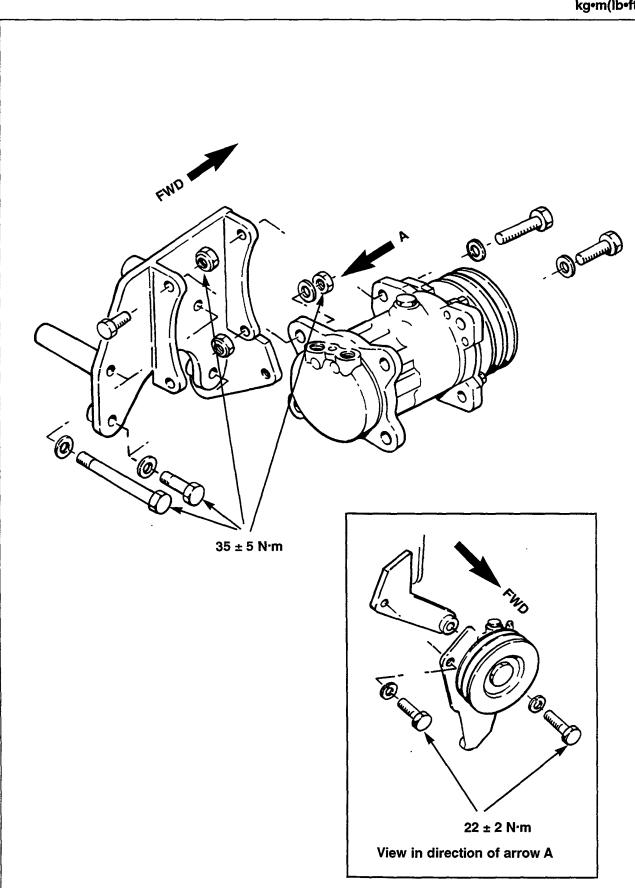
# **Engine Electricals**





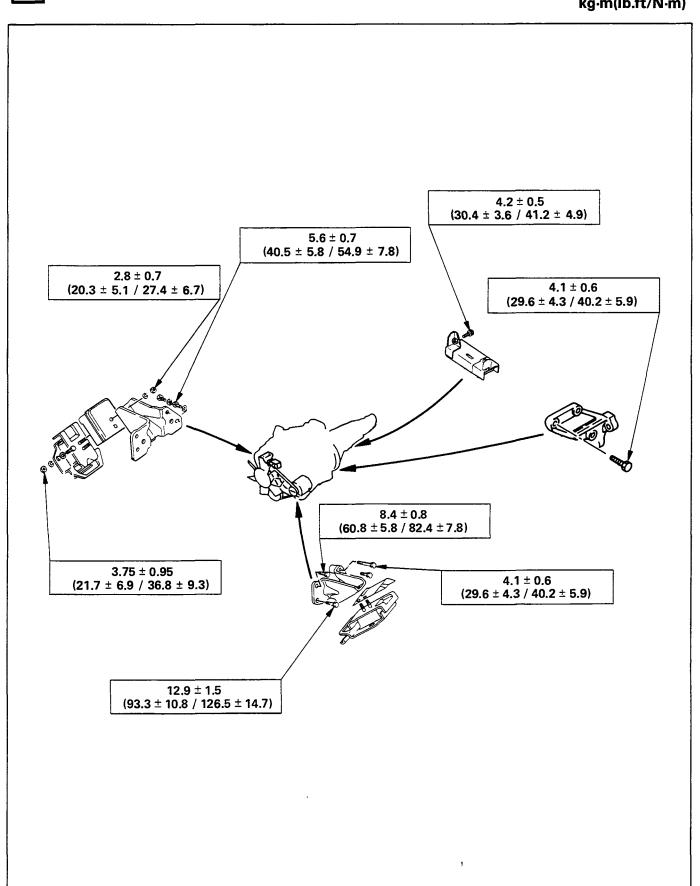
# Compressor Bracket and Oil Pump Bracket

kg•m(lb•ft/N•m )





# **Engine Mounting Bracket and Engine Stiffener**



1600



# RECOMMENDED LIQUID GASKET

Туре	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	
Water Base	ThreeBond 1141E	Three Bond	
Solvent	ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402	Three Bond Isuzu Isuzu Isuzu	
Anaerobic	LOCTITE 515 LOCTITE 518	Loctite Loctite	Recommended for transaxle repairs

<sup>\*</sup> RTV: Room Temperature Vulcanizer

#### Note:

- 1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
- 2. Be careful to use the specified amount of liquid gasket.

Follow the manufacturer's instructions at all times.

Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.

The connecting surfaces must be perfectly dry.

4. LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.

Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater

than 0.25 mm (0.01 in). Poor adhesion will result.

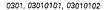


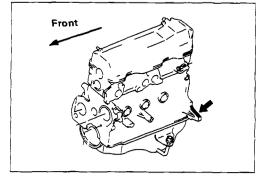
# LOCTITE APPLICATION PROCEDURE

LOCTITE Type	LOCTITE Color	Application Steps
LOCTITE 242	Blue	<ol> <li>Completely remove all lubricant and moisture from the bolts and the female threaded surfaces of the parts to be joined.         The surfaces must be perfectly dry.     </li> <li>Apply LOCTITE to the bolts.</li> </ol>
LOCTITE 262	Red	Apply LOCTITE to at least 1/3 of the bolt's threaded area.
LOCTITE 270	Green	3. Tighten the bolts to the specified torque.
LOCTITE 271	Red	<ol> <li>Wait at least one hour before continuing the installation procedure.</li> </ol>
LOCTITE 515	Violet	1. Completely remove lubricant and moisture from the connecting surfaces.  The surfaces must be perfectly dry.  2. Apply a 2.0 — 2.5 mm (0.08 — 0.10 in.) bead of LOCTITE to one of the connecting surfaces.  There must be no gaps in the bead.  LOCTITE  Bead width 2 — 2.5 mm (0.08 — 0.10 in)  Bead width 2 mm (0.08 in)  3. Tighten the bolts to the specified torque.  4. Let the joined parts set for at least thirty minutes.

# **SERVICING**

Servicing refers to general maintenance procedures to be performed by qualified service personnel.



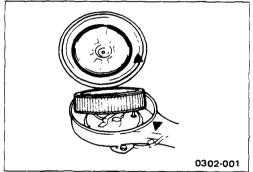


### MODEL IDENTIFICATION

#### **Engine Number**

The engine number is stamped on the protrusion at the rear left hand side of the cylinder block.



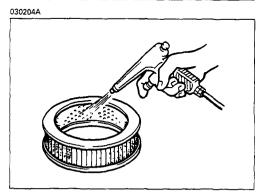


# AIR CLEANER

# Oil Wetted (Viscous) Type Paper Element

The air cleaner has an oil wetted paper element. No servicing is required until the replacement interval is reached.

Never attempt to clean the element, no matter how dirty it may appear. The element is designed to provide normal filtering efficiency until it becomes due for replacement.



#### **Dry Type Paper Element**

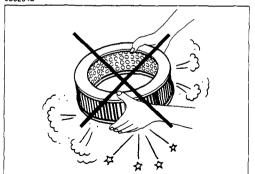
Apply compressed air to the inside of the element as you rotate it with your hand. This will blow the dust free.

Compressed Air Pressure

kg/cm<sup>2</sup>(psi/kPa)

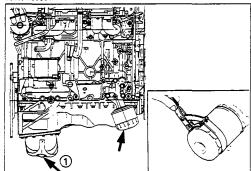
4-5 (56.9-71.1/392.3-490.3)



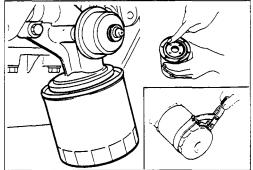


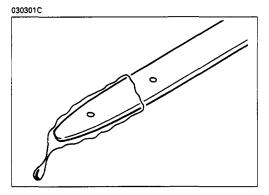
Do not bang the element against another object in an attempt to clean it. Damage to the element will result.

#### 0303, 030301A

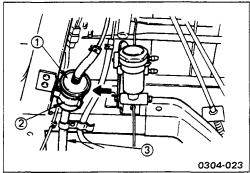


#### 030301B

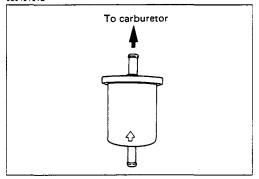




0304, 03040101A



#### 03040101B



#### LUBRICATING SYSTEM

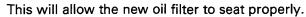
#### Oil Filter

#### Replacement Procedure

- Loosen the drain plug ① to drain the engine oil.
- Wait a few minutes and then retighten the drain plug with new gasket.
- Loosen the used oil filter by turning it counterclockwise with the filter wrench.

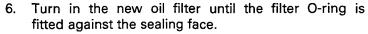


Clean the oil filter adapter fitting face.





Apply a light coat of engine oil to the O-ring.



7. Use the filter wrench to turn in the filter an additional 1 turn.

Filter Wrench: 5-8840-0203-0



- Check the engine oil level and replenish to the specified level if required.
- 9. Start the engine and check for oil leakage from the drain plug and main oil filter, then turn it off. After several minutes, recheck the engine oil level.

#### **FUEL SYSTEM**

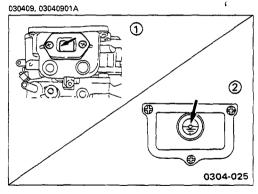
#### **Fuel Filter Replacement**

- Remove the fuel filter 1 from the filter clip 2.
- Disconnect the inlet and outlet fuel hoses 3 from the fuel filter.
- Connect the inlet and outlet fuel hoses to the new fuel filter.

Be sure to connect the fuel hoses in their correct positions.

- 4. Install the fuel filter to the filter clip.
- 5. Start the engine.

Check for fuel leakage from the fuel hoses.



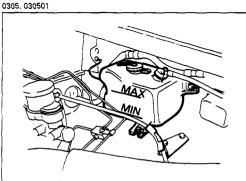


#### Carburetor

#### Float Level Inspection and Adjustment

Check the float level against the float level mark on the float chamber (Nikki) ①, and float level glass (Hitachi) ②.

If required, adjust the float level by carefully bending the float seat



# **COOLING SYSTEM**

#### Coolant Level

Check the coolant level and replenish the radiator surge tank as necessary.

If the coolant level falls below the "MIN" line, carefully check the cooling system for leakage. Then add enough coolant to bring the level up to the "MAX" line.

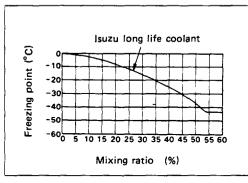
#### Note:

Do not overfill the reserve tank.

Remove the radiator filler cap only when absolutely necessary.

Always check the coolant level when the engine is cold.

Always refer to the chart at the left to determine the correct cooling water to antifreeze solution mixing ratio.





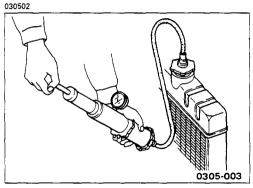
# **Cooling System Inspection**

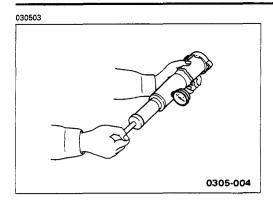
Install a radiator filler cap tester to the radiator. Apply testing pressure to the cooling system to check for leakage. The testing pressure must not exceed the specified pressure.

Testing Pressure

kg/cm² (psi/kPa)

2 (28.45/196)







#### **Radiator Cap Inspection**

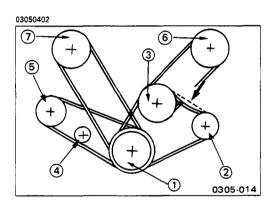
The radiator filler cap is designed to maintain coolant pressure in the cooling system at 1.05 kg/cm<sup>2</sup> (15 psi/ 103 kPa).

Check the radiator filler cap with a radiator filler cap tester. The radiator filler cap must be replaced if it fails to hold the specified pressure during the test procedure.

Radiator Filler Cap Pressure

Pressure Valve	kg/cm² (psi/kPa)
0.9 — 1.2 (12.8 — 17.1/	/88 — 118)
Negative Valve (Reference)	kg/cm² (psi/kPa)

0.01 - 0.04 (0.14 - 0.57/0.98 - 3.90)





#### **Drive Belt Adjustment**

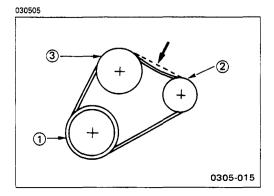
Check the drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

Drive Belt Deflection	mm(in)
Except power steering	10 (0.39)
Only power steering	14 (0.55)

Check the drive belt for cracking and other damage.

- Crankshaft pulley
- ② Alternator pulley
- 3 Cooling fan pulley
- 4 Compressor idler pulley
- ⑤ Compressor pulley
- 6 Air pump pulley
- Power steering oil pump pulley



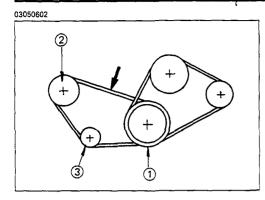


#### Cooling Fan Pulley Drive Belt

Fan belt tension is adjusted by moving the alternator.

Depress the drive belt mid-portion with a 10 kg (22 lb/98 N) force.

- ① Crankshaft pulley
- ② Alternator pulley
- 3 Cooling fan pulley



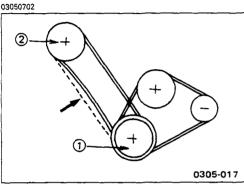


## **Compressor Pulley Drive Belt**

Move the idler pulley to adjust the compressor drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

- Crankshaft pulley
- ② Compressor pulley
- 3 Idler pulley



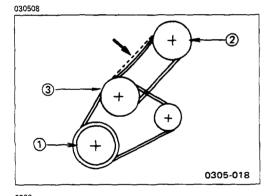


#### Power Steering Oil Pump Pulley Drive Belt

Move the oil pump to adjust the oil pump pulley drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

- ① Crankshaft pulley
- ② Oil pump pulley

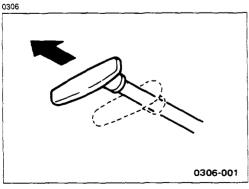




# Air Pump Pulley Drive Belt

Move the air pump to adjust the air pump pulley drive belt tension.

- Crankshaft pulley
- ② Air pump pulley
- ③ Cooling fan pulley



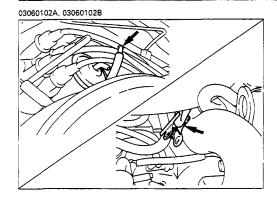


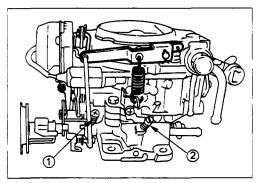
# **ENGINE CONTROL**

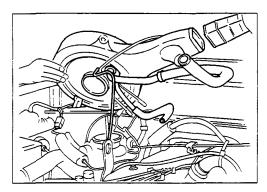
# Idling Speed and Mixture Adjustment Preparation

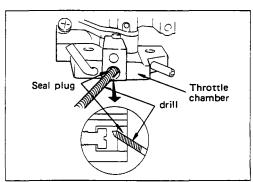
- 1. Set the parking brake and chock the drive wheels.
- 2. Place the transmission in neutral.
- 3. Start the engine and allow it to warm up.
- 4. Check that all the accessory switches are off and that the choke valve is fully open.
- 5. Set a tachometer to the engine.
- 6. Check the ignition timing and adjust it if required.

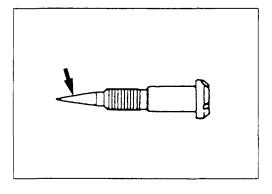
Ignition Timing (BTDC)	deg/rpm
From '91, switzerland & Sweden (4ZD1)	6/900
Other	6/800













#### Idling Speed Adjustment (Nikki Carburetor)

- 1. Disconnect the distributor vacuum hose and plug the hose end.
- 2. Bend the attached rubber hose to close off the thermo valve vacuum line.
- 3. Set the throttle adjusting screw ① to the specified idling speed.
- 4. Turn the idle adjusting screw ② to peak the engine speed.



#### Idle screw adjuster (If required); 8-9421-6632-0

- 5. Reset the throttle adjusting screw to lower the idling speed to 20 rpm below the specified level.
- 6. Turn the idle adjusting screw counterclockwise to raise the idling speed to the specified level.

Engine Idling Speed

rpm

800

 Reconnect the distributor vacuum hose and the idle compensator vacuum hose to the carburetor after completing the adjustment procedure.



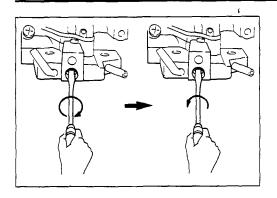


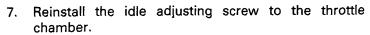
- Idle Mixture Adjustment (Hitach carburetor) (Until '90 Swiss & Sweden, and From '92 Chili models)
  - 1. Remove the air cleaner.
- 2. Tag each of the vacuum hoses leading to the carburetor.
- 3. Disconnect the harness connectors and the vacuum hoses at the carburetor.
- 4. Remove the carburetor assembly. Drill a hole in seal plug with proper tool.

- 5. Remove the idle adjusting screw from the throttle chamber.
- 6. Inspect the idle adjusting screw.

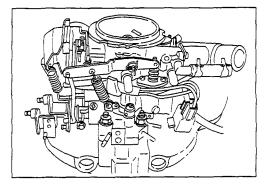
If the adjusting screw head has been damaged by the drill, the screw must be replaced with a new one.

If the adjusting screw taper is excessively worn or stepped, the screw must be replaced with a new one.





- 8. Fully screw the idle adjusting screw into the throttle chamber.
  - Do not overtighten the screw.
- 9. Back off the idle adjusting screw 3 turns.

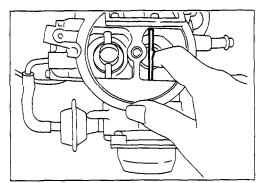




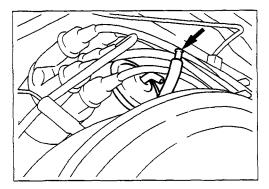
- 10. Reinstall the carburetor.
- 11. Reconnect the vacuum hoses and the harness connectors to the carburetor.

Pay close attention to the tags applied at removal.

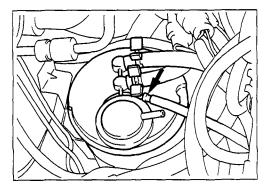
Refer to "REMOVAL AND INSTALLATION" of the carburetor 6C.



- 12. Reinstall the air cleaner.
- 13. Start the engine and allow it to idle until the cooling water reaches normal temperature.
- 14. Make sure that the choke valve is fully open. If the choke valve is not fully open, open it.

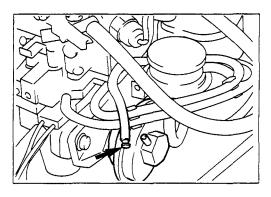


- 15. Make sure that the air conditioning system is off (if so equipped).
- 16. Move the front wheels to the straight ahead position (power steering equipped vehicle only).
- 17. Disconnect and plug the distributor line.

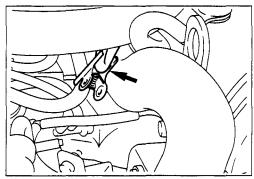


18. Disconnect and plug the canister purge line.

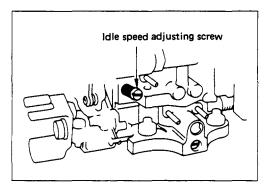
#### 6A-22 ENGINE MECHANICAL



19. Disconnect and plug the EGR vacuum line.



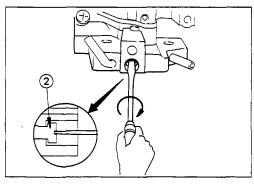
20. Bend the attached rubber hose to close off the idle compensator vacuum line.





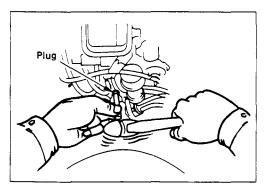
21. Use the throttle adjusting screw to adjust the idling.

Engine Idling Speed rpm
800

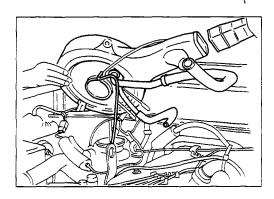


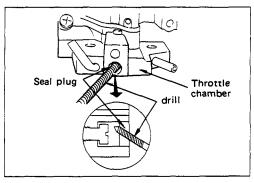


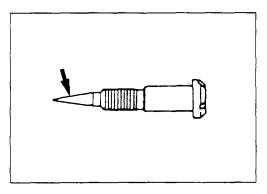
- 22. Adjust the setting of the idle adjusting screw ② to obtain the maximum speed.
- 23. Reset the throttle adjusting screw to 850 rpm.
- 24. Turn the idle adjusting screw clockwise (lean) until the engine idle speed is down to 800 rpm.

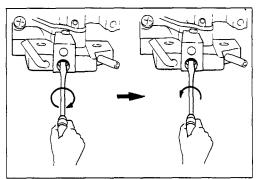


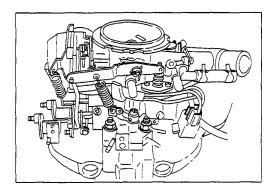
- 25. Remove the air cleaner.
- 26. Replace the idle adjusting screw plug.
  Tap the new plug in until it is flush with the carburetor surface.
- 27. Reinstall the air cleaner.













Idle Speed and Mixture Adjustment (Hitach carbure-

(From '91 Swiss, Sweden & From '92 Germany mod-

- 1. Remove the air cleaner.
- 2. Tag each of the vacuum hoses leading to the car-
- 3. Disconnect the harness connectors and the vacuum hoses at the carburetor.
- Remove the carburetor assembly. Drill a hole in seal plug with proper tool.

- Remove the idle adjusting screw from the throttle chamber.
- 6. Inspect the idle adjusting screw.
  - If the adjusting screw head has been damaged by the drill, the screw must be replaced with a new one.
- If the adjusting screw taper is excessively worn or stepped, the screw must be replaced with a new
- 7. Reinstall the idle adjusting screw to the throttle chamber.
- Fully screw the idle adjusting screw into the throttle chamber.

Do not overtighten the screw.

Back off the idle adjusting screw 3 turns.

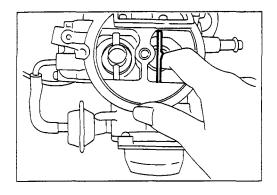


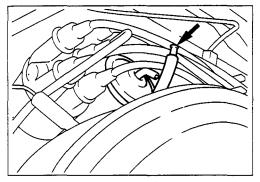
- 10. Reinstall the carburetor.
- 11. Reconnect the vacuum hoses and the harness connectors to the carburetor.

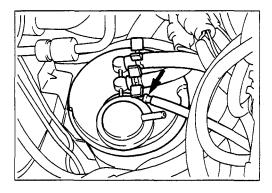
Pay close attention to the tags applied at removal.

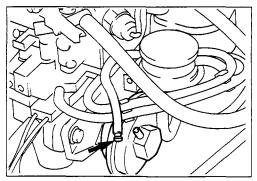
Refer to "REMOVAL AND INSTALLATION" of the carburetor 6C.

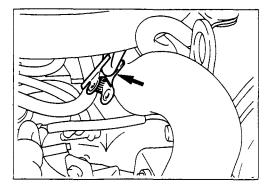










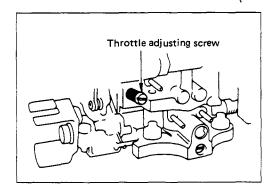


- 12. Reinstall the air cleaner.
- 13. Start the engine and allow it to idle until the cooling water reaches normal temperature.
- 14. Make sure that the choke valve is fully open. If the choke valve is not fully open, open it.
- 15. Make sure that the air conditioning system is off (if so equipped).
- 16. Move the front wheels to the straight ahead position (power steering equipped vehicle only).
- 17. Disconnect and plug the distributor line.

18. Disconnect and plug the canister purge line.

19. Disconnect and plug the EGR vacuum line.

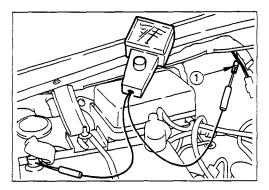
20. Bend the attached rubber hose to close off the idle compensator vacuum line.





21. Use the throttle adjusting screw to adjust the idling.

Engine Idling Speed		rpm
	900	-

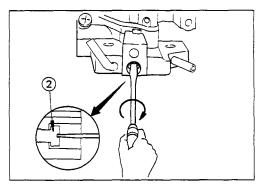


22. Use a dwell meter to measure the dwell.

Connect the positive side of the meter to the monitor lead ① and the negative side of the meter to ground. After confirming dwell or duty to vary, adjust setting of idle adjusting screw ② to obtain an average dwell or duty as specified.

Dwell	Deg.
	Dwell Meter Reading (4-Cylinder Scale)
Average	36

The dwell reading specified is the average of the most constant vibration.

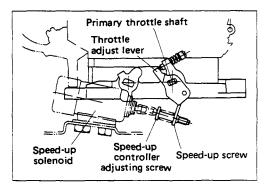




23. Use the throttle adjusting screw to reset the engine idling speed.

Engine Idling Speed	rpm
	900

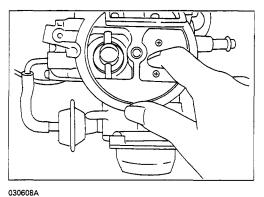
- 24. Remove the air cleaner.
- 25. Replace the idle adjusting screw plug.
  Tap the new plug in until it is flush with the carburetor surface.
- 26. Reinstall the air cleaner.



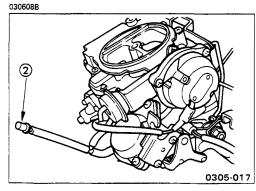


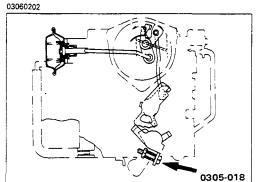
#### Idle Up Adjustment (If equipped)

- 1. Start the engine and allow it to warm up.
- 2. Turn "ON" airconditioner.
- 3. Turn the speed-up screw to 900 rpm.



# 0305-016





#### **Fast Idling Speed Adjustment Preparation**

- 1. Set the parking brake and chock the drive wheels.
- 2. Place the transmission in neutral.
- Remove the air cleaner and while holding the throttle slightly open, push the choke the valve closed, and hold it closed as you release.
- 4. Disconnect the vacuum hose ① from the choke piston and plug the hose end.

- 5. Disconnect the EGR system thermal vacuum hose ② from the carburetor and plug the hose end.
- 6. Check that all the accessory switches are off.



# Fast Idling Speed Adjustment

- Start the engine and allow it to warm up.
   Do not depress the accelerator pedal.
- 2. Set a tachometer to the engine.
- 3. Check the fast idling speed.

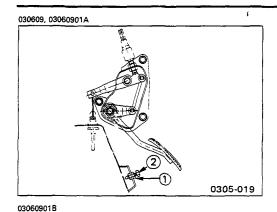
Fast Idling Speed

rpm

2,700 - 3,000

If the fast idling speed is outside the specified range, adjust it with the fast idle adjusting screw.

4. Reconnect the vacuum hose to the choke piston and install the air cleaner after completing the adjustment procedure.





# **Engine Control Adjustment**

# **Accelerator Pedal Adjustment**

Adjustment of the accelerator pedal height is not required.

- 1. Loosen the pedal stopper bolt lock nut ①.
- 2. Tighten the pedal stopper bolt ② to prevent it from interfering with the accelerator pedal.



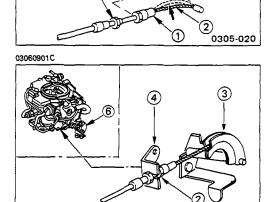
# **Engine Control Cable Adjustment**

- Fully close the throttle valve.
- 2. Turn the adjusting nut ① to adjust the engine control inner cable play ②.

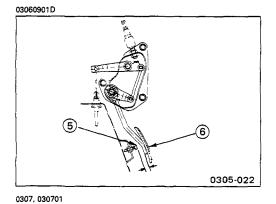
Engine Control Inner Cable Play

mm(in)

Approximately 2 - 3 (0.079 - 0.120)



- 3. Connect the engine control cable to the throttle holder ③.
- 4. Install the engine control cable to the bracket ④.
- 5. Tighten the lock nut ②.





0305-021

Fully open the throttle valve.

7. Adjust the clearance between the stopper bolt pad ⑤ and the accelerator pedal ⑥.

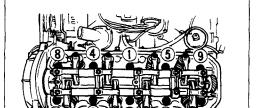


Accelerator Pedal and Bolt Pad Clearance

mm(in)

0 - 3(0 - 0.12)

 Fully depress the accelerator pedal.
 Check that the throttle valve is fully open when the pedal is fully depressed.





#### CYLINDER HEAD BOLT

### **Cylinder Head Bolt Tightening Torque Inspection**



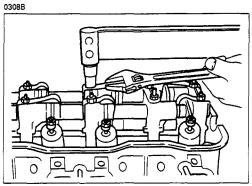
Use the torque wrench to check the cylinder head bolt tightening torque in the sequence shown in the illustration before adjusting the valve clearances.

Head Bolt Wrench: 9-8511-4209-0

Cylinder Head Bolt Torque

kg·m(ft.lbs/N·m)

 $10 \pm 1 (72.3 \pm 7.2/98.0 \pm 9.8)$ 





# **VALVE CLEARANCE ADJUSTMENT**

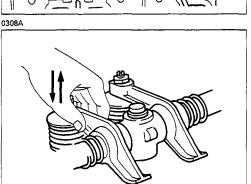
 Check the rocker arm shaft bracket nuts for looseness.

Tighten any loose rocker arm shaft bracket nuts before adjusting the valve clearance.

Rocker Arm Shaft Bracket Nut Torque kg·m(lb.ft/N·m)  $2.2 \pm 0.25 (16.0 \pm 1.8/21.6 \pm 2.5)$ 

 Bring the piston in either the No. 1 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft pulley TDC line is aligned with the timing mark.

If the No. 1 cylinder is at TDC, there will be play in the No. 1 cylinder valve rocker arms.



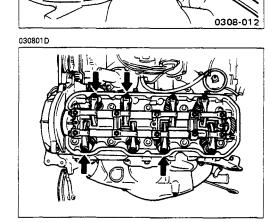


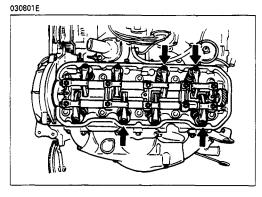
3. Adjust the valve clearances in the following manner using a feeler gauge.

Feeler gauge should move with a very slight drag.

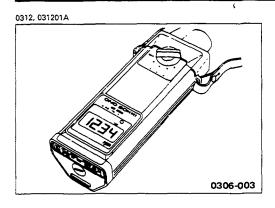
lve Clearance		mm
	At Cold	At Hot
Intake	0.15 (0.006)	0.20 (0.008)
Exhaust	0.25 (0.010)	0.30 (0.012)

4. Adjust the clearance of the valve (arrowed).





5. Turn the crankshaft one full turn (360 degrees) and adjust the clearances of the valves (arrowed).





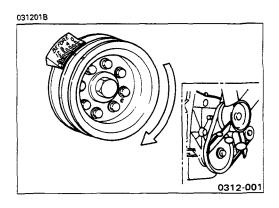
# **IGNITION TIMING**

#### **Ignition Timing Inspection**

- 1. Start the engine and allow it to idle for warm up.
- 2. Set the engine tachometer.
- 3. Check that the engine is running stably at the specified idling speed.

If the vehicle is equipped with an air conditioner, the air conditioner switch must be in the "OFF" position.

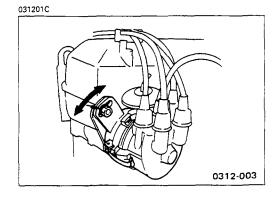
Engine Idling Speed	rpm	
From '91, Switzerland, Sweden & From '92, Germany	900	
Other	800	



- 4. Disconnect the vacuum hose.
- 5. Attach the timing light cord to either the No. 1 or the No. 4 cylinder.
- 6. Aim the timing light at the crankshaft pulley notched line to check the ignition timing.

Ignition Timing (BTDC)	deg/rpm	
From '91, Switzerland, Sweden & From '92, Germany	6/900	
Other	6/800	

If the ignition timing differs from the specification, adjust it by moving the distributor.



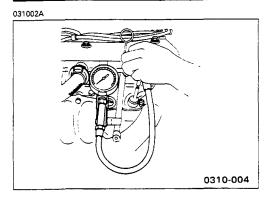


## **Ignition Timing Adjustment**

- 1. Loosen the distributor fixing bolt.
- 2. Aim the timing light at the crankshaft pulley notched line to check the ignition timing.

Moving the distributor to the left will advance the timing.

Moving the distributor to the right will retard the timing.





# COMPRESSION PRESSURE MEASURE-MENT

- 1. Start the engine and allow it to idle for warm up.
- 2. Set the engine tachometer.
- 3. Stop the engine.
- 4. Remove all of the spark plugs.
- 5. Engage the starter and check that the cranking speed is at least 300 rpm.
  - If the cranking speed is less than 300 rpm, the battery must be replaced.
- 6. Set a compression gauge to the No. 1 cylinder spark plug hole.
- 7. Turn the engine over with the starter motor and take the compression reading.

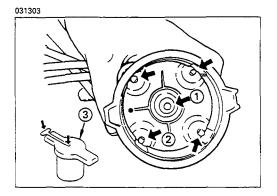
Compression Pressure	kg/cm²(psi/kPa) at 300 rpm	
Standard	Limit	
12.0 (170.6/1,177.2)	8.0 (113.7/784.5)	

Repeat the procedure (Steps 6 and 7) for the remaining cylinders.



# **IGNITION SYSTEM**

If a problem in the ignition system is believed to be the cause of engine trouble, perform the following checks and make the required adjustments, repairs, and part replacements.



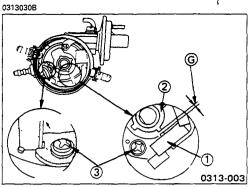
#### Distributor

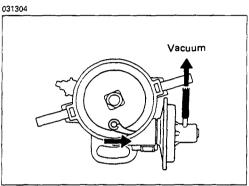
1. Distributor Cap and Rotor

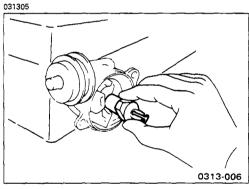
Remove the distributor cap and check the following:

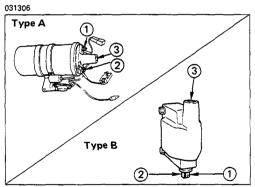
- 1) Check the center electrode ① and the side electrode ② for burning and corrosion.
- Check the rotor ③ for excessive wear and burning.Replace the parts as required.

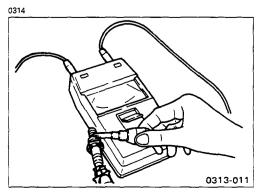
0313













2. Air Gap

Use a feeler gauge to measure the clearance between the signal generator ① and the distributor cam ②.

If the measured value is outside the specified value, adjust the air gap by loosening the two screws 3 and moving the bracket.

Air Gap ⑥

mm(in)

0.2 - 0.4 (0.008 - 0.016)

#### Vacuum Adavancer

- Disconnect the vacuum hose from the vacuum advancer.
- 2. Connect a vacuum pump to the vacuum advancer diaphragm.
- Apply a vacuum and check that the vacuum advancer moves.

If the vacuum advancer does not move, repair or replace as necessary.



#### Governor

- 1. Check the rotor shaft for excessive looseness.
  - If the shaft is excessively loose, the governor is defective and must be replaced.
- Turn the rotor shaft clockwise 1/4 of a turn and release it.

The rotor shaft should spring back.

If the shaft does not spring back, the governor is defective and must be replaced.



#### **Ignition Coil**

Use a circuit tester to measure the resistance of the primary coil and the secondary coil.

If either of the measured values is outside the specified value, the ignition coil must be replaced.

Ignition Coil Resistance

	Type A	Туре В
Primary Coil ① — ②	$1.1 - 1.4\Omega$	$1.2 - 1.4\Omega$
Secondary Coil ① - ③	12.2 $-$ 14.9 $\Omega$	$8.6 - 13.0 \Omega$



# SPARK PLUG

#### Insulation Resistance Inspection

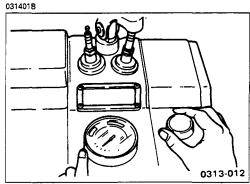
Use an ohmmeter to measure the insulation resistance.

If the measured value is less than the specified value, the spark plug must be replaced.

Insulation Resistance

 $\mathsf{M}\Omega$ 

More than 5

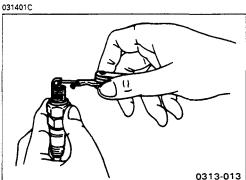




# Insulation Resistance Inspection (Using a Spark Plug Tester)

Use the spark plug tester to check for excessive carbon deposits, cracked insulation resulting in short circuiting, and terminal abrasion resulting in voltage surging.

If any of these conditions are discovered, the spark plug must be replaced.



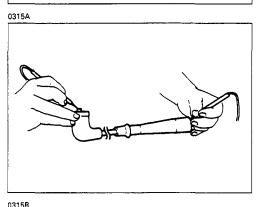


#### Spark Plug Gap Adjustment

Measure the spark plug gap and inspect the spark plugs.

Adjust the spark plug gap if required.

Spark Plug Gap	mm(in
Without catalytic	0.7-0.8
converter vehicle	(0.028-0.031)
With catalytic	1.0-1.1
converter vehicle	(0.040-0.043)



# **HIGH TENSION CABLE**

- Check the cable for broken insulation.
   If there is broken insulation, the cable must be replaced.
- Check the terminals for corrosion and looseness.
   If the terminals are corroded or loose, the cable must be replaced.



3. Measure the cable resistance.

If the measured resistance deviates from the specified value, the cable must be replaced.

Cable Resistance		KΩ/m
	9.6 — 22.4	

#### Note:

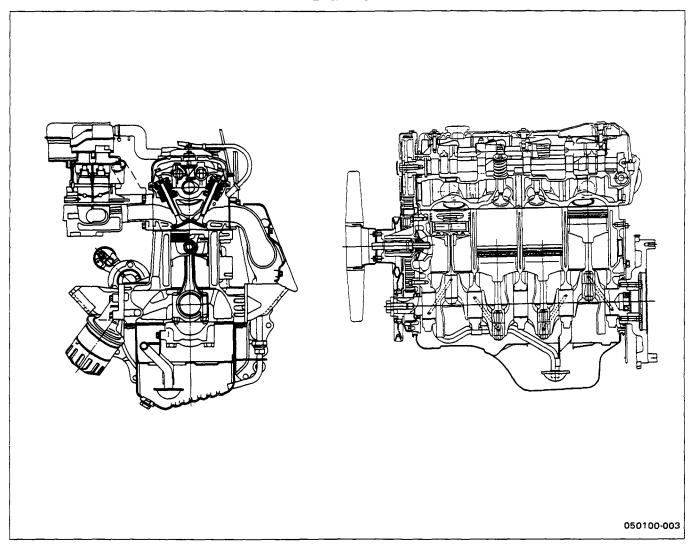
The cable contains a synthetic conductor which is easily damaged.

Never stretch or kink the cable.

Never stick a needle or the pointed end of a probe into the cable during a timing check. An increase in resistance will occur at that point, causing the cable to burn.

050102A

# **GENERAL DESCRIPTION**



050102B, 050102C

The 4Z Series model engine, designed to meet the strictest emission control regulations, is used on TFR and TFS vehicles.

This engine features aluminum alloy cylinder heads and hemispherical combustion chambers. The cross-flow intake and exhaust port valves have a "V" configuration.

A one-piece cast iron cylinder body is used. The oil pump and the water pump are built into the upper front of the cylinder body.

The crankshaft is supported by five bearings for optimum stiffness. The counter weights are forged as part of the crankshaft.

The timing train consists of the timing belt and the single overhead camshaft (SOHC).

050201



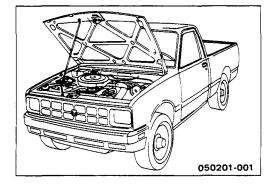


# **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

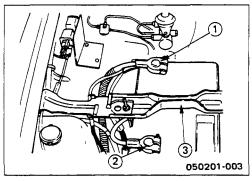
# Important Operations - Removal

- Carefully remove the piping, hoses, wiring harness connectors, engine control cables, and control rods from the engine.
- Remove the clutch control line, the back up light switch connector, and the speedometer cable from the transmission.



# **Engine and Transmission**

The engine and transmission must be removed from the engine separately.



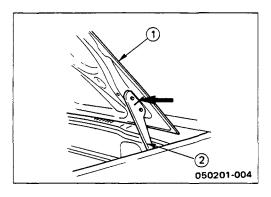
#### **Battery**

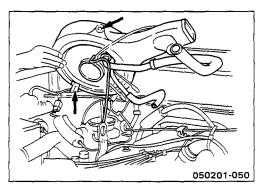
- 1. Disconnect the battery cable ① and the grounding cable ② from the battery terminals.
- Remove the battery clamp ③.
   Take care not to accidentally short the battery with the spanner or some other tool.
- 3. Remove the battery.
- 4. Disconnect the battery cable at the starter motor and the ground cable at the cylinder body.

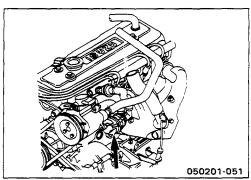


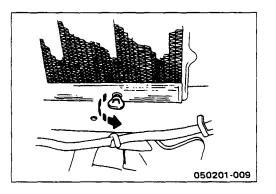
Apply setting marks to the engine hood ① and the engine hood hinges ② before removing the engine hood.

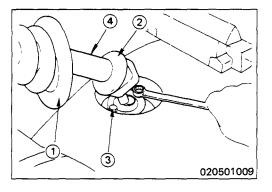
This will facilitate installation of the engine hood to its original position.











### Air Cleaner

Remove the air cleaner from the engine.

### Note:

Cover the air cleaner intake port to prevent the entry of foreign material.

### Coolant

Remove the coolant drain plug (at the lower left of the engine) and the radiator drain plug.

Allow the engine coolant to drain completely.

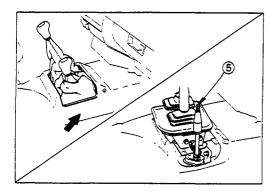
If long life coolant is used, drain the coolant into a clean plastic connector for reuse.

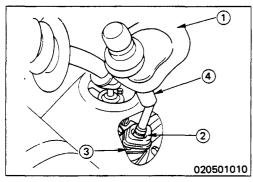
### Radiator

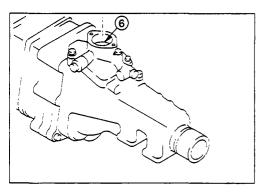
- 1. Remove the radiator grill from the deflector panel.
- 2. Remove the radiator undercover from the sidemembers (For  $4 \times 4$ ).
- 3. Disconnect the radiator upper and lower hoses from the engine side.
- 4. Remove the radiator fan shroud and the cooling fan.
- Remove the radiator.Be careful not to damage the radiator core.

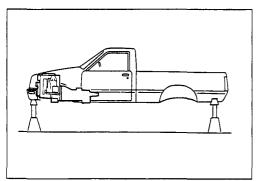
### **Gear Shift Lever**

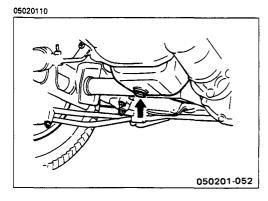
- 1. Place the gear shift lever in the neutral position.
- 2. Remove the front console from the floor panel.
- 3. Pull the gear shift lever grommet ① and the dust cover ② to the top of the gear shift lever.
- 4. Remove the gear shift lever cover bolt 3.
- 5. Remove the gear shift lever 4.











- 6. Remove the change lever hole cover ⑤ or the center console from the front floor.
- 7. Remove the quadrant box **(§)** from the transmission rear cover.

### Note:

Cover the quadrant box hole to prevent the entry of foreign material into the transmission.

# Transfer Change Lever (For 4 ×4)

Perform this procedure after removing the gear shift lever.

- 1. Place the transfer change lever in the "H" position.
- 2. Pull the transfer change lever grommet ① and the dust cover ② to the top of the transfer change lever.
- 3. Remove the retainer bolts 3.
- 4. Remove the transfer change lever ④ along with the retainer and ball seat cover.
- 5. Remove the change lever hole cover ⑤ or the center console from the front floor.
- 6. Remove the quadrant box **(6)** from the transfer case adapter.

### Note:

Cover the quadrant box hole and the transfer change lever hole to prevent the entry of foreign material into the transmission.

## Lifting the Vehicle

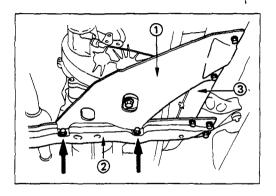
- 1. Jack up the vehicle.
- Place chassis stands at the front and the rear of the vehicle.
- 3. Remove the wheels from the chassis.

# **Engine Oil Draining**

Remove the oil pan drain plug to drain the engine oil.

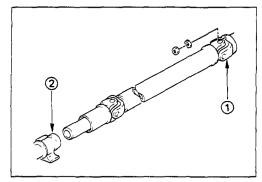
Do this while the engine is hot.

Do not forget to reinstall the drain plug after draining the engine oil.



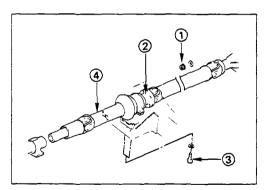
## Transfer Case Protector

Remove the transfer case protector ① from the transmission mounting member ② and the side member ③.



# Rear Propeller Shaft (Single Shaft Type)

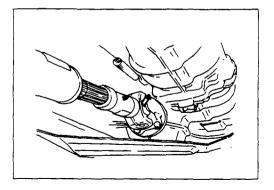
- 1. Remove the propeller shaft flange yoke at the drive pinion side ①.
- 2. Remove the propeller shaft from the transmission main shaft spline ②.



## Rear Propeller Shaft (Dual Shaft Type)

- Apply setting marks to the center coupling flange yoke and the 2nd propeller shaft flange yoke.
  - This will prevent mispositioning during the installation procedure.
- 2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
- 3. Remove the 2nd propeller shaft flange yoke bolts ② at the center coupling side.
- 4. Remove the center bearing retainer bolts 3.
- 5. Remove the 1st propeller shaft ④ with the center bearing.

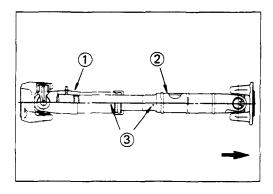
Pull the 1st propeller shaft toward the rear of the vehicle until the spline yoke is free of the transmission main shaft.

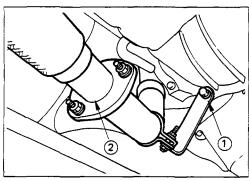


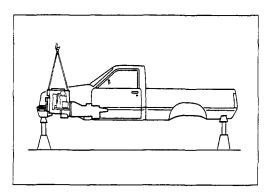
# Front Propeller Shaft (For $4 \times 4$ )

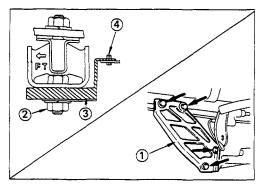
Remove the splined yoke flange bolt at the transfer case side.

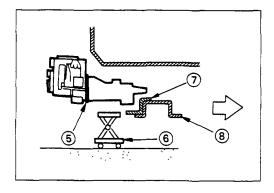
Do not allow the splined yoke to fall away from the front propeller shaft.











If the splined yoke should fall away from the front propeller shaft, align the setting marks ③ on the splined yoke ① and the front propeller shaft ② to reassemble the two parts.

The setting marks are punched circles approximately 3 mm (0.12 in) in diameter.

# **Exhaust Pipe**

- Remove the exhaust pipe bracket ① from the transmission case.
- 2. Disconnect the front exhaust pipe from the exhaust manifold and the 2nd exhaust pipe ②.

# **Engine Lifting Hanger**

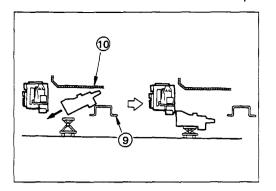
- Attach the engine lifting hanger to the rear portion of the exhaust manifold.
- 2. Attach the lifting wire to both ends of the engine lifting hanger.

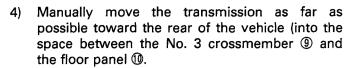
### Transmission (For $4 \times 2$ )

- Support the transmission with a transmission jack.
- 2. Disconnect the engine stiffener ① from the cylinder body and the engine rear plate.
- 3. Remove the engine rear mounting rubber nuts 2 from the mounting rubber bracket 3.
- 4. Loosen the mounting rubber bracket bolts 4.
- 5. Remove the transmission from the engine.

The removal of the transmission will require the cooperative efforts of two mechanics.

- 1) Remove the transmission nuts and bolts ⑤ from the engine rear plate.
- 2) Operate the transmission jack **(6)** to slightly raise the transmission.
- 3) Remove the rear mounting rubber bracket ? from the mounting rubber from the No. 3 crossmember §.





5) Lower the clutch housing end of the transmission toward the transmission jack.

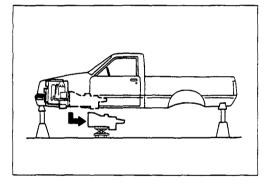
The rear of the transmission is supported by the No. 3 crossmember at this time.

6) Firmly grasp the transmission rear cover (1st mechanic).

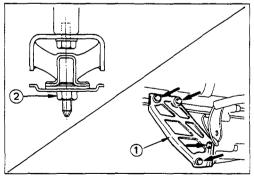
Raise the transmission jack toward the transmission (2nd mechanic).

Carefully lower the transmission onto the transmission jack.

The transmission must be centered on the transmission jack.

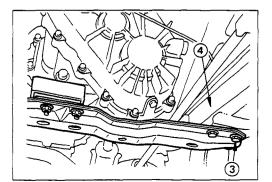


6. Carefully pull the transmission jack with the transmission from beneath the vehicle.



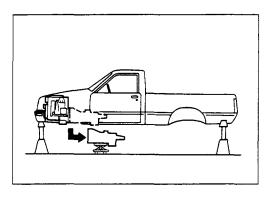
# Transmission with Transfer Case (For $4 \times 4$ )

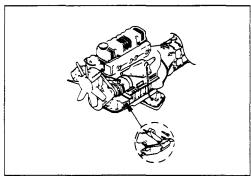
- 1. Support the transmission with a transmission jack.
- 2. Disconnect the engine stiffener ① from the cylinder body and the engine rear plate.
- 3. Remove the engine rear mounting nuts 2.

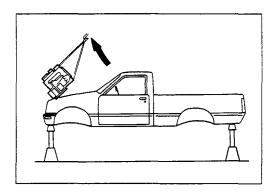


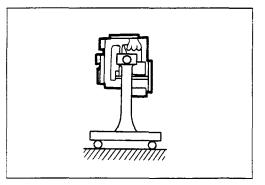
- 4. Loosen the mounting member bolts ③.
- 5. Remove the mounting member from the sidemembers ④.

### **6A-40 ENGINE MECHANICAL**









- 6. Remove the transmission with the transfer case from the engine.
  - 1) Remove the transmission nuts and bolts from the engine rear plate.
  - 2) Carefully pull the transmission with the transmission jack toward the rear of the vehicle.
  - Operate the transmission jack to slowly lower the transmission.

# **Engine**

. Remove the engine mounting rubber nuts attaching the mounting rubbers to the sidimembers.

2. Operate the hoist to slightly raise the engine.

The front of the engine should be held slightly higher than the rear.

Be careful not to damage the brake pipe and the fuel pipe.

Continue to slowly raise the engine from the engine compartment.

Hold the front of the engine higher than the rear.

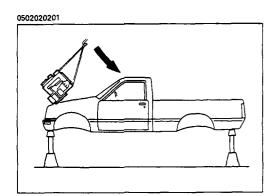
4. Place the engine on an engine stand.

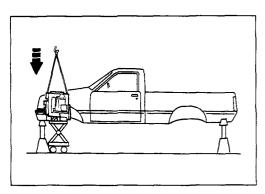


6

# Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



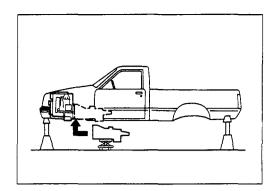


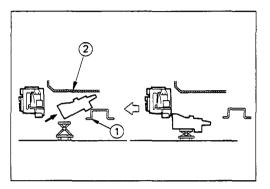
# **Engine**

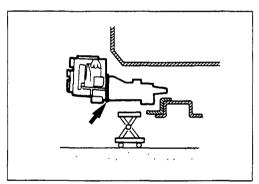
- 1. Attach a lifting wire to the engine lifting hangers.
- 2. Operate the hoist to position the engine above the engine compartment.

The front of the engine should be held slightly higher than the rear.

- 3. Lower the engine slowly into the engine compartment.
  - Be careful not to damage the brake pipe, the fuel pipe, and the air breather.
- 4. Support the oil pan with a jack.
- 5. Temporarily tighten the engine mounting rubber nuts.









### Transmission (For $4 \times 2$ )

- Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Place the transmission with the mounting rubbers on a transmission lack.
- Carefully move the transmission jack and transmission into position behind the engine.
- Slowly operate the transmission jack to raise the transmission until the rear of the transmission is at the same level as the No. 3 crossmember (1).
- Manually support the transmission rear cover. Move the transmission into position between the No. 3 crossmember and the floor panel 2.

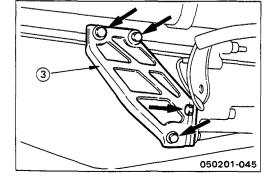


Slowly raise the transmission lack until the front of the transmission is aligned with the rear of the en-

The slope of the engine and the transmission must be the same.

- Align the top gear shaft spline with the clutch drive plate spline.
- Install the transmission to the engine. 8.
- Tighten the transmission nuts and bolts to the specified torque.

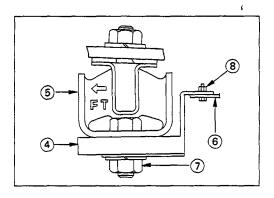
Transmission Nut and Bolt Torque kg·m(lb.ft/N·m)  $3.8 \pm 0.8 (27.5 \pm 5.8/37.2 \pm 7.8)$ 





- 10. Connect the engine stiffener 3 to the cylinder body and the engine rear plate.
- 11. Tighten the stiffener bolts to the specified torque.

Stiffener Bolt Torque  $kg \cdot m(lb.ft/N \cdot m)$  $4.1 \pm 0.6 (29.7 \pm 4.3/40.2 \pm 5.9)$ 

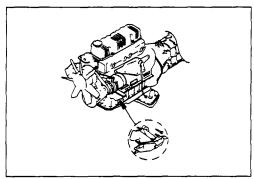




- 12. Install the rear mounting rubber bracket (4) to the mounting rubber (5) and the No. 3 crossmember (6).
- 13. Tighten the rear mounting rubber nuts ⑦ and the mounting bracket bolts ® to the specified torque.

Rear Mounting Rubber Nut Torque kg·m(lb.ft/N·m)  $8.5 \pm 0.5$  (61.5  $\pm 3.6/83.3 \pm 4.9$ )

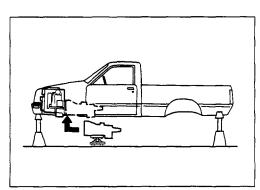
Mounting Bracket Bolt Torque kg·m(lb.ft/N·m)  $3.8 \pm 0.1 (27.1 \pm 6.9/36.8 \pm 9.3)$ 





 Tighten the engine mounting rubber nuts to the specified torque.

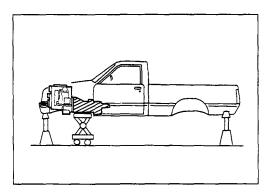
Engine Mounting Rubber Nut Torque kg·m(lb.ft/N·m)  $4.2 \pm 0.5 (30.4 \pm 3.6/41.2 \pm 4.9)$ 





# Transmission with Transfer (For $4 \times 4$ )

- Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Place the transmission with the mounting rubbers on a transmission jack.
- 3. Carefully move the transmission jack and transmission into position behind the engine.





 Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

The slope of the engine and the transmission must be the same.

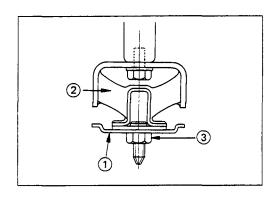
- Align the top gear shaft spline with the clutch driven plate spline.
- 6. Install the transmission to the engine.

Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque kg·m(lb.ft/N-m)

 $3.8 \pm 0.8 (27.5 \pm 5.8/37.2 \pm 7.8)$ 

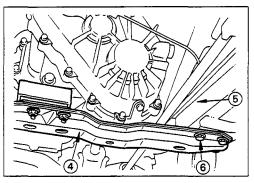
### **6A-44 ENGINE MECHANICAL**





- 7. Install the mounting member ① to the mounting rubber ②.
- 8. Tighten the mounting member nuts 3 to the specified torque.

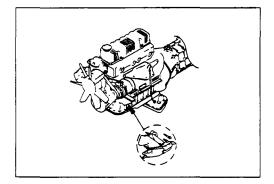
Mounting Rubber Nut Torque	kg·m(lb.ft/N·m)
$4.2 \pm 0.5 (30.4 \pm 3.6/41.2)$	2 ± 4.9)





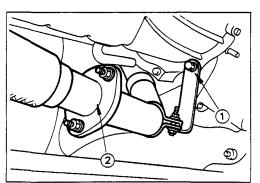
- Install the mounting member 
   to the sidemembers
- 10. Tighten the mounting member bolts **(6)** to the specified torque.

Mounting Member Bolt Torque	kg-m(lb.ft/N-m)
7.8 ± 1.6 (56.1 ± 11.2/76.0 ±	15.2)



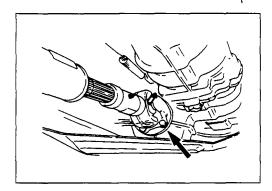
11. Tighten the engine mounting rubber nuts to the specified torque.

Engine Mounting Rubber Nut Torque kg·m(lb.ft/N·m)  $4.2 \pm 0.5 (30.4 \pm 3.6/41.2 \pm 4.9)$ 



# **Exhaust Pipe**

- 1. Connect the exhaust pipe to the exhaust manifold and the 2nd exhaust pipe ①.
- Install the exhaust pipe bracket ② to the transmission case.





# Front Propeller Shaft (For 4 ×4)

- Connect the propeller shaft flange yoke to the matching flange.
- 2. Tighten the propeller shaft flange yoke bolt to the specified torque.

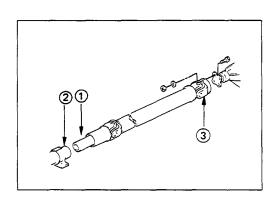
Propeller Shaft Flange Yoke Bolt

Torque	kg-m(lb.ft/N-m)
Only 4ZE1 eng.	$6.4 \pm 0.4 \ (46.3 \pm 2.9/62.8 \pm 3.9)$
Other	$3.6 \pm 0.3 \; (26.0 \pm 2.2/35.3 \pm 2.9)$

### Note:

If the splined yoke and the front propeller shaft have accidentally separated, align their setting marks and recouple them.

Refer to "FRONT PROPELLER SHAFT REMOVAL".



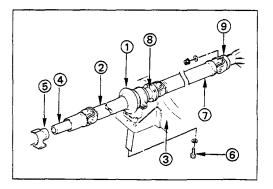


# Rear Propeller Shaft (Single Shaft Type)

- 1. Insert the splined yoke ① with the propeller shaft into the transmission main shaft spline ②.
- 2. Install the propeller shaft flange yoke ③ to the drive pinion side.
- 3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt

l orque	kg-m(lb.ft/N-m)
Only 4ZE1 eng.	$6.4 \pm 0.4 \ (46.3 \pm 2.9/62.8 \pm 3.9)$
Other	$3.6 \pm 0.3 \; (26.0 \pm 2.2/35.3 \pm 2.9)$





# Rear Propeller Shaft (Dual Shaft Type)

- Place the center bearing and retainer ① together with the 1st propeller shaft ② on the No. 4 crossmember ③.
- 2. Insert the splined yoke ① into the transmission main shaft spline ⑤.
- 3. Tighten the center bearing retainer bolts ® to the specified torque.

Center Bearing Retainer Bolt Torque kg·m(lb.ft/N·m)  $6.2 \pm 0.2$  (44.8  $\pm 1.5/60.8 \pm 2.0$ ) 4. Connect the 2nd propeller shaft ⑦ to the center coupling ® and the drive pinion ⑨.

Be sure to align the setting marks applied at disassembly.

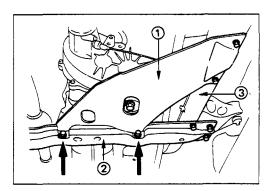
5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt

Torque	kg·m(lb.ft/N·m)
Only 4ZE1 eng.	$6.4 \pm 0.4 \ (46.3 \pm 2.9/62.8 \pm 3.9)$
Other	$3.6 \pm 0.3 \; (26.0 \pm 2.2/35.3 \pm 2.9)$

### Note:

At the propeller shaft installation, the three universal yoke's spider pin center (A), (B) and (C) (shown in the illustration) must be aligned on the straight line to couple them in the proper universal joint phase.

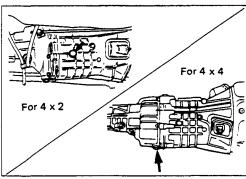




# Transfer Case Protector (For 4 x 4)

- Install the transfer case protector ① to the mounting member ② and the sidemembers ③.
- Tighten the transfer case protector bolts to the specified torque.

Protector Bolt Torque	kg-m(lb.ft/N-m)
$3.7 \pm 1.0 (26.8 \pm 7.2)$	2/36.3 ± 9.8)





### **Gear Shift Lever**

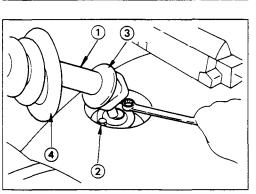
 Replenish the transmission case and the transfer case with the specified engine oil.

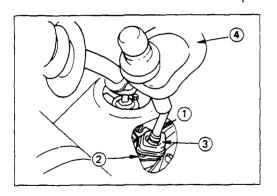
Transmission and Transfer Case Oil		il lit(US/UK gal)
	4 × 2	4 × 4
MSG 4	1.25 (0.33/0.28)	
MSG 5	1.55 (0.41/0.34)	4.40 (1.16/0.99)
MUA	2.95 (0.77/0.64)	T/M: 2.95 (0.97/0.64) T/F: 1.45 (0.38/0.31)

- Install the quadrant box to the transmission rear cover.
- 3. Install the gear shift lever ① to the transmission case.
- 4. Tighten the gear shift lever cover ② bolts to the specified torque.

Shift Lever Cover Bolt Torque	kg·m(lb.ft/N·m)
$2.0 \pm 0.2$ '(14.5 $\pm$ 1.5/19.6	± 2.0)

5. Install the dust cover 3 and the grommmet 4.



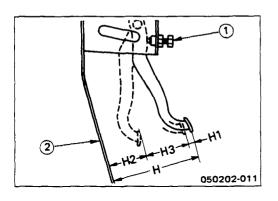


# Transfer Change Lever (For 4 × 4)

- 1. Insert the transfer change lever ① into the transfer side case.
- 2. Install the ball seat cover along with the change lever retainer ②.
- 3. Tighten the change lever retainer bolts to the specified torque.

Change Lever Retainer Bolt Torque	kg·m(lb.ft/N·m)
$2.0 \pm 0.2$ (14.5 $\pm$ 1.5/19.6	± 2.0)

4. Install the dust cover 3 and the grommet 4.





# **Clutch Pedal Adjustment**

- 1. Reconnect the clutch control cable to the shift fork.
- 2. Adjust the clutch pedal height "H" with the stopper bolt or pedal switch ①.
- 3. Check the clutch pedal travel "H3".

Clutch	Pedal Travel	mm(in
	RHD	LHD
Н	194 — 204 (7.6 — 8.0)	185 — 195 (7.3 — 7.7)
H1	15-20 (0.6-0.8) for Cable type	
5-10 (0.2-0.6) for H		or Hydraulic type
H2	35 (1.4)	30 (1.2)
		<del></del>

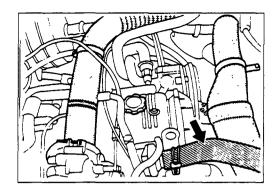
H: Pedal height from the pedal board ②

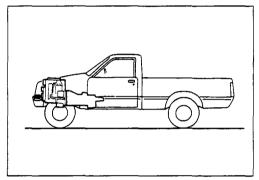
H1: Pedal free play

H2: Clearance between the clutch pedal and the pedal board ② with the clutch disengaged.

# **Engine Control Cable**

Reconnect the engine control cable to the carburetor control lever.





### Radiator

- Install the radiator.
   Be careful not to damage the retainer core.
- 2. Install the cooling fan and the fan shroud.
- 3. Connect the radiator upper and lower hoses.
- Carefully reconnect the components tagged at removal.
- 5. Install the radiator undercover to the sidemembers.
- 6. Install the radiator grill to the deflector panel.

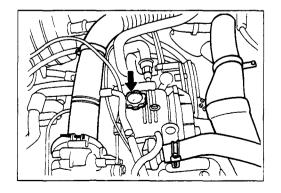
# Lowering the Vehicle

- 1. Install the wheels to the vehicle.
- 2. Place a jack beneath the vehicle.
- 3. Raise the jack to remove the chassis stands.
- 4. Lower the vehicle to the ground.

## **Coolant Replenishment**

Replenish the cooling system with coolant.

Coolant Capacity	lit(US/UK gal)	
4ZC1	8.6 (2.27/1.89)	
4ZD1/4ZE1	9.0 (2.38/1.98)	



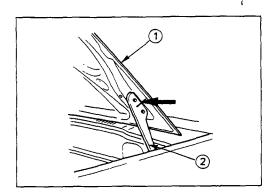


# **Engine Oil Replenishment**

1. Fill the engine through the new filler port with new engine oil of the specified grade.

Engine Oil Capacity and Grade		lit(US/UK gal)
( anacity		4.9 (1.29/1.08) 5.5 (1.45/1.21)
Grade	SE,	, SF

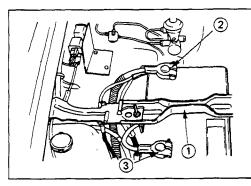
- 2. Start the engine and allow it to idle for several minutes.
- 3. Stop the engine and wait five minutes for the oil to settle.
- 4. Recheck the oil level and replenish if necessary.





# **Engine Hood**

Align the setting marks (applied at removal) on the engine hood ① and the engine hood hinges ② to install the engine hood.





### Battery

- 1. Check the battery fluid level and the specific gravity.
- 2. Secure the battery with the battery clamp ①. Do not overtighten the battery clamp.
- 3. Connect the battery cable ② and the ground cable ③ to the battery.
- 4. Connect the battery cable to the starter motor and the ground cable to the cylinder body.
- 5. Apply grease to the battery terminals.

## **Engine Warm-Up**

After completing the required maintenance procedures, start the engine and allow it to idle until it is warm.

Check the following:

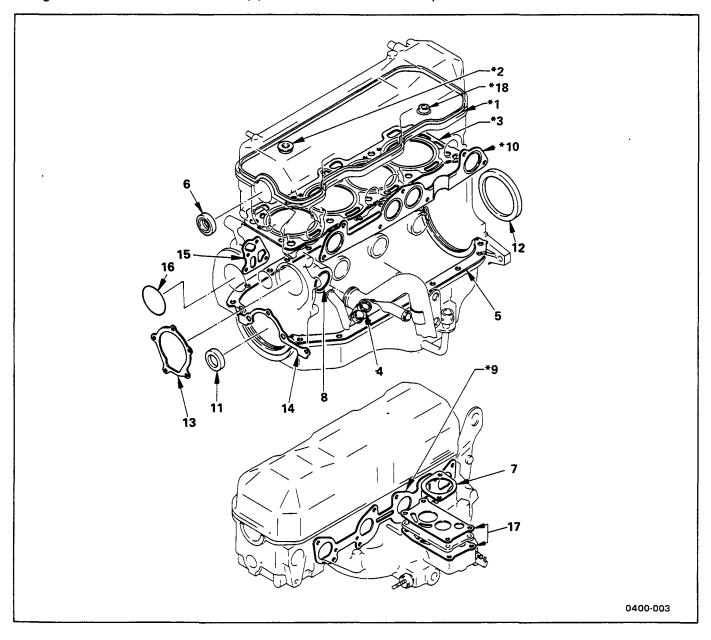
- Engine idling speed
   Refer to "SERVICING" for the idling speed adjustment procedure.
- 2. Engine noise level
- Engine lubricating system and cooling system Carefully check for oil and coolant leakage.
- 4. Engine control cable operation
- 5. Clutch engagement
- 6. Indicator warning light operation

0400A

# **ENGINE REPAIR KIT**

All of the numbered parts listed below are included in the Engine Repair Kit.

The gaskets marked with an asterisk (\*) are also included in the Top Overhaul Kit.



#### 040002B, 040002C

- 1. Cylinder head cover gasket
- \* 2. Cylinder head cover bolt gasket
- \* 3. Cylinder head gasket
  - 4. Oil pan drain plug gasket
  - 5. Oil pan gasket
  - 6. Camshaft front oil seal
  - 7. Intake manifold outlet pipe gasket
  - 8. Water pipe O-ring
- \* 9. Intake manifold gasket

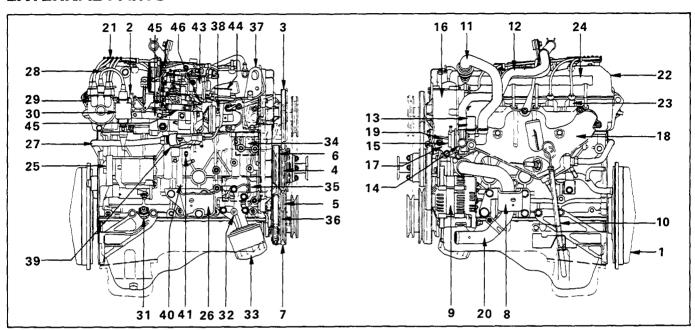
- \* 10. Exhaust manifold gasket
  - 11. Crankshaft front oil seal
  - 12. Crankshaft rear oil seal
  - 13. Water pump gasket
  - 14. Retainer gasket
  - 15. Oil filter adapter gasket
  - 16. Oil Pump O-ring
  - 17. Heat insulator gasket
- \* 18. Valve stem oil seal

# **ENGINE OVERHAUL**



# **DISASSEMBLY**

# **EXTERNAL PARTS**



# **Disassembly Steps**

[V]: Optional on some models

		' '				
•	1.	Clutch pressure plate assembly		23.	Spark plug	
		and driven plate assembly		24.	Air manifold with check valve	[V]
	2.	Condenser	[V]	25.	Starter motor	
	3.	Air pump drive belt	[V]	26.	Engine foot with mounting rubber	
	4.	Compressor drive belt	[V]	27.	EGR pipe	[V]
	5.	Cooling fan drive belt		28.	High tension cable (Ignition coil	
	6.	Cooling fan pulley			to distributor)	
	7.	Crankshaft pulley		29.	Distributor	
	8.	Engine foot with mounting rubber		30.	Ignition coil	[V]
	9.	Alternator and bracket		31.	Oil pressure switch	
	10.	Dipstick and guide tube		32.	Oil pressure unit	[V]
	11.	Rubber hose (A.S.V. to check		33.	Oil filter adapter with oil filter	
		valve)	[V]	34.	Power steering oil pump and	
	12.	Rubber hose (Air pump to air			bracket	[V]
		cleaner)	[V]	35.	Compressor and bracket	[V]
	13.	Rubber hose (Air pump to A.S.V.)	[V]	36.	Compressor idler pulley and	
	14.	Rubber hose (A.S.V. to air intake			bracket	[V]
		duct bracket)	[V]	37.	Front engine hanger	
	15.	Air switching valve or air bypass		38.	EGR valve	[V]
		valve	[V]	39.	EGR adapter	[V]
	16.	Air pump	[V]	40.	Fuel damper	
	17.	Air pump bracket "B"	[V]	41.	Fuel pump	
	18.	Exhaust manifold			Water outlet pipe	
	19.	Air pump bracket "A"	[V] ▲	43.	Carburetor	
	20.	Water intake pipe		44.	BP transducer and bracket	[V]
	21.	High tension cable			Intake manifold	
	22.	Cylinder head cover		46.	Fast idle solenoid (with A/C)	

05030001

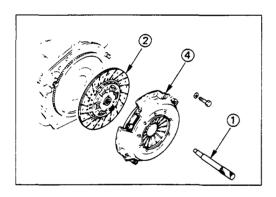


# **Important Operations**

### **Emission Control Vacuum Hoses**

Tag each of the emission control vacuum hoses before disassembly.

This will ensure that the hoses are reconnected correctly.

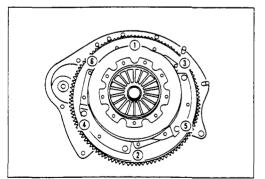




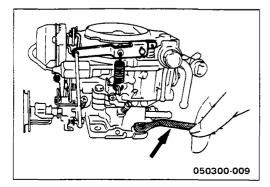
# 1. Clutch Pressure Plate Assembly and Driven Plate Assembly

1) Use the clutch pilot aligner ① to prevent the driven plate assembly ② from falling free.

Clutch Pilot Aligner: 5-8525-3001-0 (J-24547)



- Loosen the clutch cover bolts in the numerical order shown in the illustration.
- 3) Remove the pressure plate assembly 3 from the flywheel.
- 4) Remove the driven plate from the flywheel.





## 43. Carburetor

- 1) Disconnect the PCV hose, the fuel rubber hose, and the switch valve from the carburetor.
- 2) Use the carburetor wrench to remove the carbure-

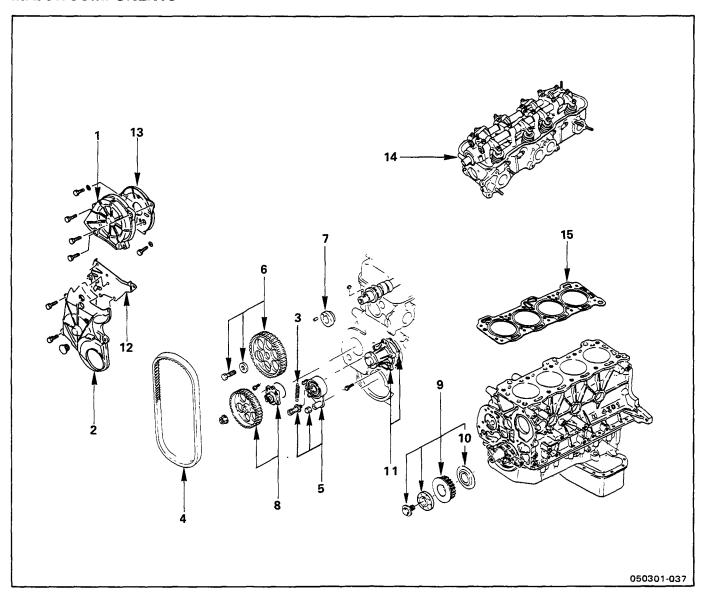
Carburetor Wrench: 5-8511-9003-0 (J-26510)

05030601A



# **INTERNAL PARTS**

## **MAJOR COMPONENTS**

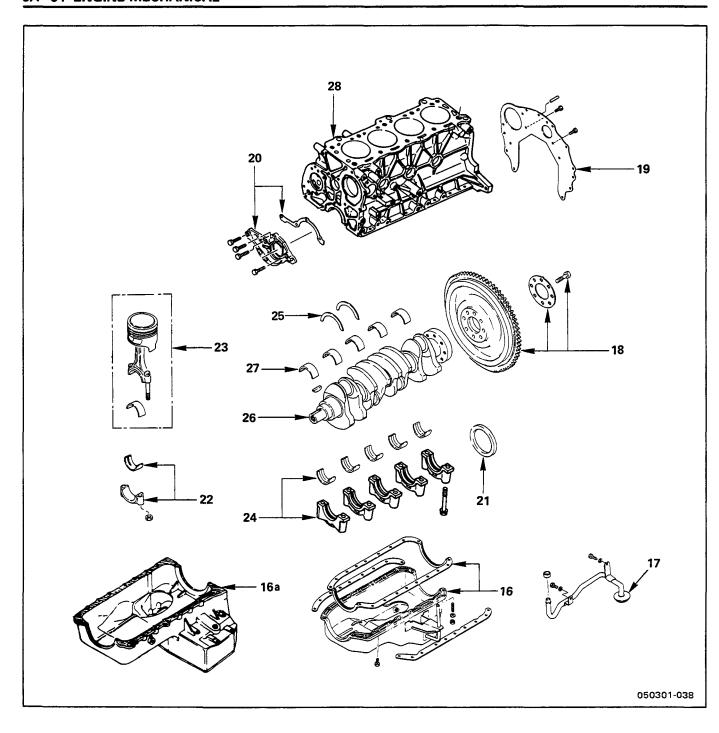


# **Disassembly Steps-1**

- 1. Timing belt upper cover
- 2. Timing belt lower cover
- ▲ 3. Tension spring
- ▲ 4. Timing belt
- ▲ 5. Tension pulley
- ▲ 6. Camshaft timing pulley
  - 7. Camshaft boss
- ▲ 8. Oil pump with timing pulley

- 9. Crankshaft timing pulley
- 10. Timing belt guide plate
- 11. Water pump
- 12. Cylinder body front plate (Lower)
- 13. Cylinder head front plate (Upper)
- ▲ 14. Cylinder head with rocker arm shaft and camshaft
  - 15. Cylinder head gasket

## **Inverted Engine**



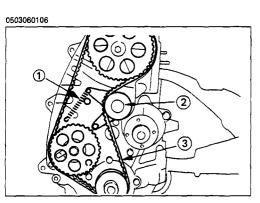
0503060002D, 0503060002E

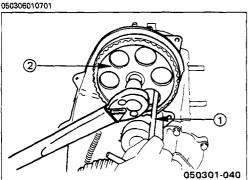
# **Disassembly Steps-2**

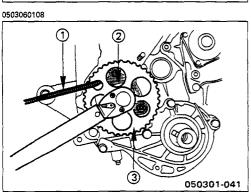
- 16. Oil pan (For  $4 \times 2$  except 4ZE1)
- 16a. Oil pan (For  $4 \times 4$  and 4ZE1)
- 17. Oil strainer
- ▲ 18. Flywheel and bolt
  - 19. Cylinder body rear plate
  - 20. Crankshaft front oil seal retainer
  - 21. Crankshaft rear oil seal
- ▲ 22. Connecting rod bearing cap with lower bearing
- ▲ 23. Piston and connecting rod with upper bearing
- ▲ 24. Crankshaft bearing cap with lower bearing
  - 25. Crankshaft thrust bearing
  - 26. Crankshaft
- ▲ 27. Crankshaft upper bearing
  - 28. Cylinder body

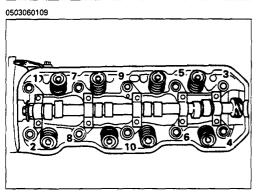


# **Important Operations**









## 3. Tension Spring

- 4. Timing Belt
- 5. Tension Pulley
- 1) Remove the tension spring.
- 2) Loosen bolt ①, draw the tension pulley ② fully to the water pump side.
- 3) Remove the timing belt 3.
- 4) Remove the tension pulley.

## 6. Camshaft Timing Pulley

1) Set a T-bar wrench ① to one of the timing cover bolts through a timing pulley hole.

This will prevent the timing pulley ② from turning.

Loosen the timing pulley bolt and remove the timing pulley.

# 8. Oil Pump with Timing Pulley

Use a 6 mm (0.24 in) Allen wrench ① to remove the oil pump ② along with the oil pump timing pulley ③ and the rotor.



# 14. Cylinder Head with Rocker Arm Shaft and Camshaft

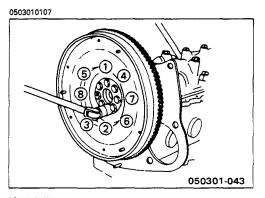
Use the extension bar wrench to loosen the cylinder head bolts in numerical order a little at a time.

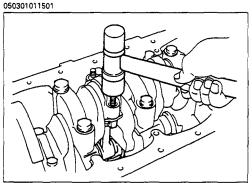
Extension Bar Wrench: 9-8511-4209-0 (J-24239-01)

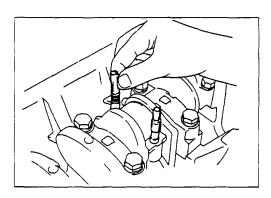
### Note:

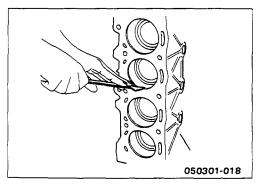
Head warpage could result from bolts removing in incorrect order.

### **6A-56 ENGINE MECHANICAL**









## 18. Flywheel

- 1) Block the crankshaft with a piece of hard wood to prevent the flywheel from turning.
- Loosen the flywheel bolts in numerical order a little at a time.

# 22. Connecting Rod Bearing Cap with Lower Bearing

Remove the connecting rod cap nuts.

Using a plastic-faced hammer, ligtly tap the connecting rod bolts and lift off the rod connecting cap.

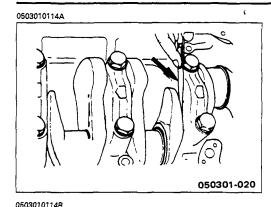
Note:

Keep the lower bearing insert with the connecting rod cap.

Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

# 23. Piston and Connecting Rod with Upper Bearing

- Remove carbon deposits from the upper portion of the cylinder wall with a scraper before removing the piston and connecting rod.
- 2) Move the piston to the top of the cylinder and tap it with a hammer grip or similar object from the connecting rod lower side to drive it out.





# 24. Crankshaft Bearing Cap with Lower Bearing

 Measure the crankshaft end play at the center journal of the crankshaft.

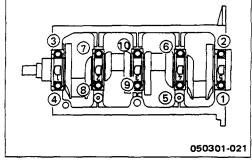
If the measured value exceeds the specified limit, the crankshaft thrust bearing must be replaced.

Crankshaft End Play		
Standard	Limit	
0.06 - 0.25 (0.0024 - 0.0099)	0.3 (0.012)	

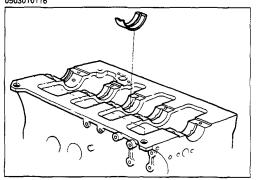
2) Loosen the bearing cap bolts in numerical order a little at a time.

#### Note:

- Keep the lower bearing and bearing cap together.
- Arrange the bearing caps and lower thrust washers in correct order.



### 0503010116



# 27. Crankshaft Upper Bearing

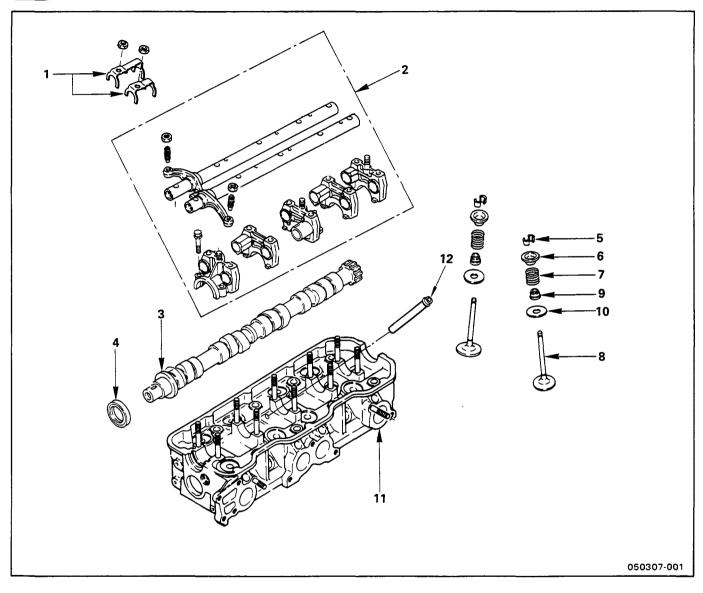
### Note:

 Keep the upper bearing and upper thrust washer to gether with the cylinder block. 0503030001A

# MINOR COMPONENTS



# CYLINDER HEAD WITH ROCKER ARM SHAFT AND CAMSHAFT



0503030001B

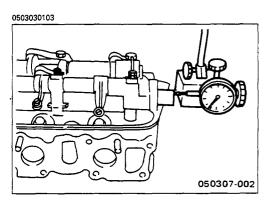
# **Disassembly Steps**

- ▲ 1. Rocker arm shaft bracket nut and spring (No.1 No.4)
- ▲ 2. Rocker arm shaft, rocker arm, and bracket
- ▲ 3. Camshaft
  - 4. Camshaft front oil seal
- ▲ 5. Split collar
  - 6. Valve spring upper seat

- 7. Valve spring
- ▲ 8. Intake and exhaust valve
  - 9. Valve stem oil seal
  - 10. Valve spring lower seat
  - 11. Cylinder head
  - 12. Fuel pump push rod

# $\overline{\mathbb{V}}$

# **Important Operations**



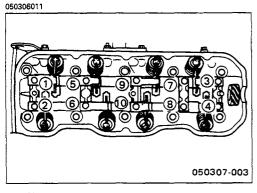


- 1. Rocker Arm Shaft Bracket Nut and Spring (No.1 No.4)
- 2. Rocker Arm Shaft, Rocker Arm, and Bracket
- 3. Camshaft
- 1) Measure the camshaft end play before removing the rocker arm shaft, the bracket, and the camshaft.
- 2) Camshaft End Play Measurement

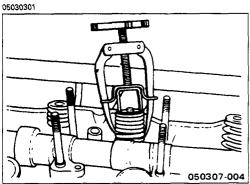
Use a dial indicator to measure the camshaft end play.

If the measured value exceeds the specified limit, the camshaft and/or the cylinder head must be replaced.

Camshaft End Play	mm(ir	
Standard	Limit	
0.050 — 0.114 (0.0020 — 0.0044)	0.2 (0.008)	



3) Loosen the rocker arm shaft bracket bolts in numerical order a little at a time.





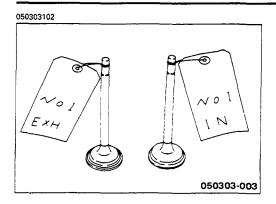
## 5. Split Collar

- 1) Place the cylinder head on a flat wooden surface.
- Use the spring compressor to remove the split collars.

Do not allow the valve to fall from the cylinder head.

Spring Compressor: 5-8840-0205-0 (J-26513-A)

### 6A-60 ENGINE MECHANICAL

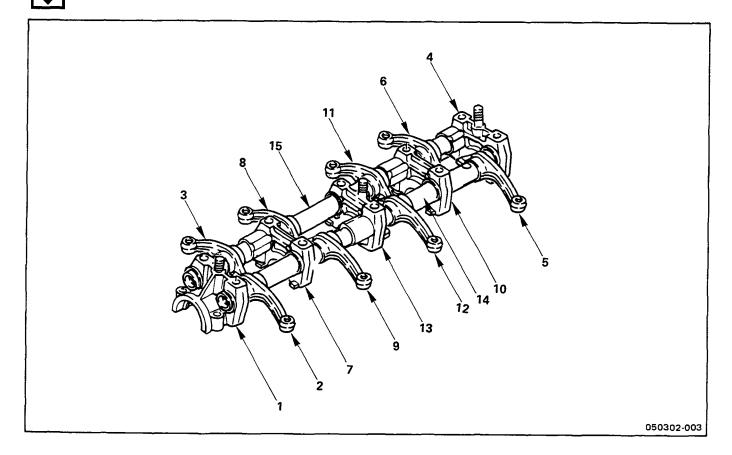


8. Intake and Exhaust Valve Note:

Arrenge the intake and exhaust valves.

0503020001A

# **ROCKER ARM SHAFT AND ROCKER ARM**



0503020001B

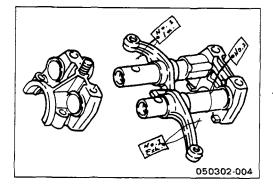
## **Disassembly Steps**

- 1. No. 1 rocker arm shaft bracket
- 2. No. 1 exhaust valve rocker arm
- 3. No. 1 intake valve rocker arm
- 4. No. 5 rocker arm shaft bracket
- 5. No. 4 exhaust valve rocker arm
- 6. No. 4 intake valve rocker arm
- 7. No. 2 rocker arm shaft bracket
- 8. No. 2 intake valve rocker arm

- 9. No. 2 exhaust valve rocker arm
- 10. No. 4 rocker arm shaft bracket
- 11. No. 3 intake valve rocker arm
- 12. No. 3 exhaust valve rocker arm
- 13. No. 3 rocker arm shaft bracket
- 14. Rocker arm shaft (Exhaust side)
- 15. Rocker arm shaft (Intake side)



## **Important Operations**



### ▲ Rocker Arm Shaft Bracket

### ▲ Rocker Arm

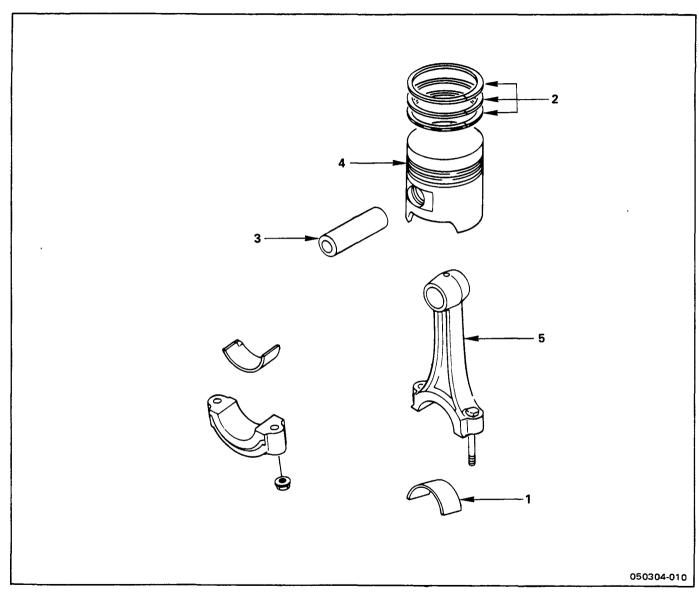
If the rocker arms and rocker arm shaft brackets are to be reused, they must be installed to their original positions.

Tag each rocker arm with the cylinder number from which it was removed.

Tag each rocker arm shaft bracket with the position from which it was removed (1, 2, 3, 4 and 5 from front to back).

050304A

# **PISTON AND CONNECTING ROD**



0503040001B

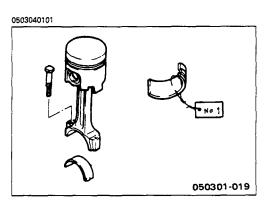
# **Disassembly Steps**

- ▲ 1. Connecting rod bearing
- ▲ 2. Piston ring▲ 3. Piston pin

- 4. Piston
- ▲ 5. Connecting rod

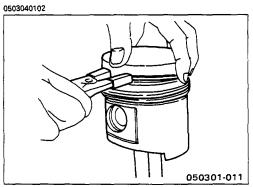
# $\nabla$

# **Important Operations**



# 1. Connecting Rod Bearing

If the connecting rod bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

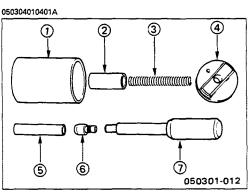


# 2. Piston Ring

- 1) Clamp the connecting rod in a vise.
- Take care not to damage the connecting rod.
- 2) Use a piston ring replacer to remove the piston rings.

Piston Ring Replacer:

Do not attempt to use some other tool to remove the piston rings. Piston ring stretching will result in reduced piston ring tension.



## 3. Piston Pin

- 4. Piston
- 5. Connecting Rod

Piston Pin Replacement Using The Special Tool Piston Pin Replacer: 5-8840-0359-0 for 4ZC1

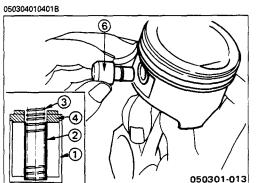
- 5-8840-0361-0 for 4ZD1/4ZE1
- ① Body② Spring guide⑤ Removal guide
- Spring guideTerrioval guideDriver handle
- 4 Adapter

# Adapte

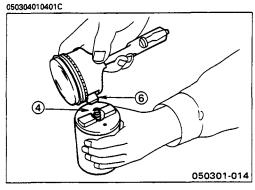


## **Piston Pin Removal Procedure**

- 1) Set the spring guide ②, the spring ③, and the adapter ④ to the body ①.
- 2) Install the removal guide 6 to the piston pin.

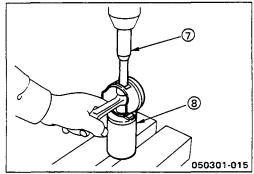


### 6A-64 ENGINE MECHANICAL



3) Set the piston with the removal guide (6) to the top side of the adapter (4).





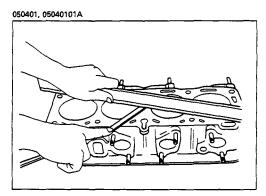
- 4) Place the piston pin replacer ® (now holding the piston) on a bench press.
- 5) Use the bench press and the driver handle ① to slowly force out the piston pin.
- 6) Remove the connecting rod from the piston.

0504



# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

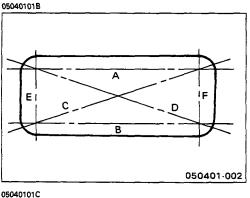




### **CYLINDER HEAD**

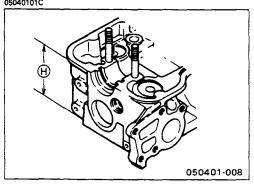
# Cylinder Head Lower Face Warpage

- Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder head lower face.
- 2. Regrind the cylinder head lower face if the measured values are greater than the specified limit but less than the maximum grinding allowance.



If the measured values exceed the maximum grinding allowance, the cylinder head must be replaced.

Cylinder Head Lowe	mm(in)	
Standard	Limit	Maximum Grinding Allowance
0.05 (0.002) or less	0.2 (0.008)	0.4 (0.016)



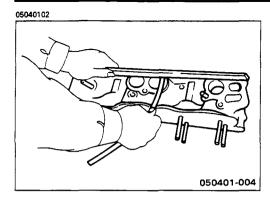


Cylinder Head Height (Reference)	mm(in)	
Standard		
93.15 — 93.25 (3.667 — 3.671)		

### Note:

If the cylinder head lower face is reground, valve depression must be checked.

### 6A-66 ENGINE MECHANICAL





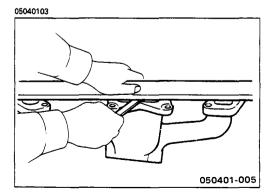
# **Manifold Fitting Face Warpage**

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

Regrind the manifold cylinder head fitting faces if the measured values are greater than the specified limit but less than the maximum grinding allowance.

If the measured values exceed the maximum grinding allowance, the cylinder head must be replaced.

Manifold Fitting Fac	mm(in)	
Standard	Limit	Maximum Grinding Allowance
0.05 (0.002) or less	0.20 (0.008)	0.40 (0.016)





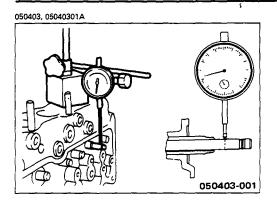
# **Exhaust Manifold Warpage**

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

Regrind the exhaust manifold cylinder head fitting faces if the measured values are between the specified limit and the standard.

If the measured values exceed the specified limit, the manifold must be replaced.

mm(in)
Limit
0.20 (0.008)





# **VALVE GUIDE**

# Valve Stem and Valve Guide Clearance

# **Measuring Method**

- 1. With the valve stem inserted in the valve guide, set the dial indicator needle to "0".
- 2. Move the valve head from side to side.

Read the dial indicator.

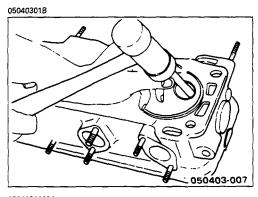
Note the highest dial indication.

If the measured values exceed the specified limit, the valve and the valve guide must be replaced as a set.

Valve Stem Clearance

mm(in)

	Standard	Limit
Intake Valve	0.0230.056 (0.00090.0022)	0.200 (0.0080)
Exhaust Valve	0.038-0.070 (0.0015-0.0028)	0.250 (0.0098)





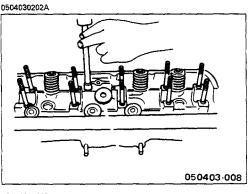
# Valve Guide Replacement

# Valve Guide Removal



Use a hammer and the valve guide replacer to drive out the valve guide from the cylinder head lower face.

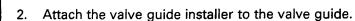
Valve Guide Replacer: 5-8523-0002-0 (J-26512-1)





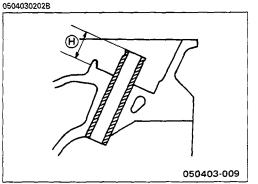
### Valve Guide Installation

1. Apply engine oil to the valve guide outer circumference.



- Attach the valve guide installer to the valve guide.
   Use a hammer to drive the valve guide into position
- from the cylinder head upper face.

Valve Guide Installer: 5-8523-0002-0 (J-26512-2)



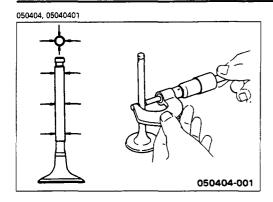


 Measure the height of the valve guide upper end from the upper face of the cylinder head.

Valve Guide Upper End Height (H) (Reference) mm(in) 16.1 - 16.3 (0.634 - 0.642)

## Note:

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.





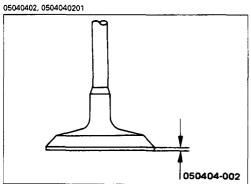
### **VALVE AND VALVE SEAT INSERT**

## Valve Stem Outside Diameter

Measure the valve stem diameter at three points.

If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

Valve Stem Outsid	Valve Stem Outside Diameter	
	Standard	Limit
Intake Valve	7.949 — 7.961 (0.3129 — 0.3134)	7.88 (0.3102)
Exhaust Valve	7.932 — 7.946 (0.3118 — 0.3124)	7.85 (0.3090)





## **Valve Thickness**

Measure the valve thickness.

If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

Intake and Exhaust	ntake and Exhaust Valve Thickness	
	Standard	Limit
Intake Valve	1.1 (0.043)	0.8 (0.031)
Exhaust Valve	1.3 (0.051)	1.0 (0.040)



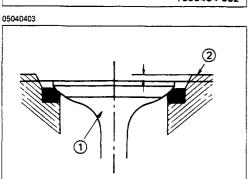
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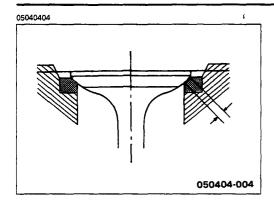
# **Valve Depression**

- Install the valve ① to the cylinder head ②.
- Use a depth gauge or a straight edge with steel rule to measure the valve depression from the cylinder head lower surface.

If the measured value exceeds the specified limit, the valve seat insert must be replaced.

Valve Depression	mm(in)	
Standard	Limit	
1.0 (0.040)	1.7 (0.067)	







### Valve Contact Width

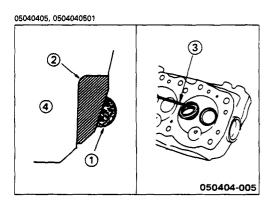
 Check the valve contact faces for roughness and unevenness.

Make smooth the valve contact surfaces.

2. Measure the valve contact width.

If the measured value exceeds the specified limit, the valve seat insert must be replaced.

mm(in	
Limit	
2.0 (0.08)	





# Valve Seat Insert Replacement

### Valve Seat Insert Removal



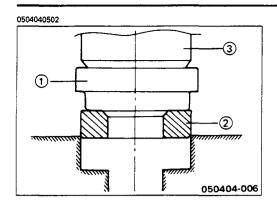
- 1. Arc weld the entire inside circumference ① of the valve seat insert ②.
- 2. Allow the valve seat insert to cool for a few minutes.

This will invite contraction and make removal of the valve seat insert easier.

3. Use a screwdriver 3 to pry the valve seat insert free.

Take care not to damage the cylinder head 4.

4. Carefully remove carbon and other foreign material from the cylinder head insert bore.





### Valve Seat Insert Installation

1. Carefully place the attachment ① (having a smaller outside diameter than the valve seat insert) on the valve seat insert ②.

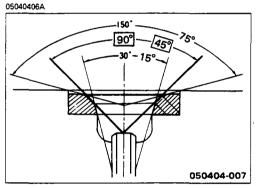
### Note:

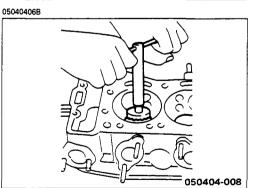
The smooth side of the attachment must contact the valve seat insert.

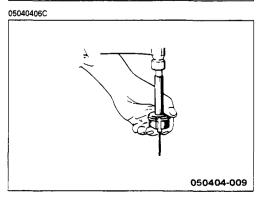
 Use a bench press ③ to gradually apply pressure to the attachment and press the valve seat insert into place.

#### Note:

Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.









## Valve Seat Insert Correction

- Remove the carbon from the valve seat insert surface.
- 2. Use a valve cutter (15°, 45°, and 75° blades) to minimize scratches and other rough areas. This will bring the contact width back to the standard value.

Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

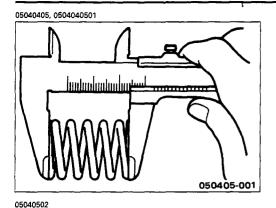
Valve Seat Angle	degree
45°	

### Note:

Use an adjustable valve cutter pilot.

Do not allow the valve cutter\_pilot to wobble inside the valve guide.

- 3. Apply abrasive compound to the valve seat insert surface.
- 4. Insert the valve into the valve guide.
- Turn the valve while tapping it to fit the valve seat insert.
- 6. Check that the valve contact width is correct.
- 7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.





#### **VALVE SPRING**

#### Valve Spring Free Height

Use a vernier caliper to measure the valve spring free height.

If the measured value is less than the specified limit, the valve spring must be replaced.

Inner Spring and Outer Spring Free Height		mm(in)
Standard	Limit	
48.1 (1.894) 46.5 (1.83)		



#### Valve Spring Squareness

Use a surface plate and a square to measure the valve spring squareness.

If the measured value exceeds the specified limit, the valve spring must be replaced.

Inner and Outer Spring Squarenes	ssmm(in)
2.1 (0.08)	



#### **Valve Spring Tension**

Use a spring tester to measure the valve spring tension.

If the measured value is less than the specified limit, the valve spring must be replaced.

Valve Spring Tension		kg(lb/N)
Compressed Height	Standard	Limit
41.0 mm (1.61 in)	23.1-27.1 (50.8-59.6/ 226.38-265.58)	22.0 (48.4/ 215.60)



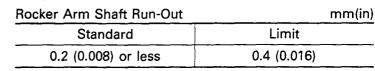
#### **ROCKER ARM SHAFT AND ROCKER ARM**

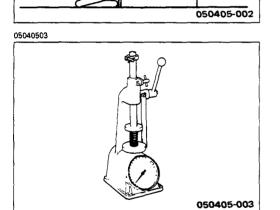
#### Rocker Arm Shaft Run-Out

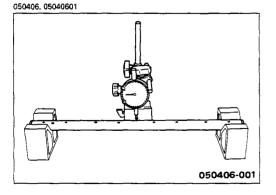
- Place the rocker arm shaft on a V-block.
- 2. Use a dial indicator to measure the rocker arm shaft central portion run-out.

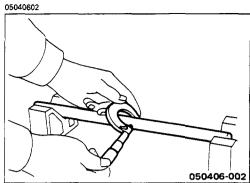
If the run-out is very slight, correct the rocker arm shaft run-out with a bench press. The rocker arm must be at cold condition.

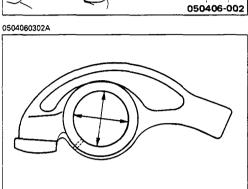
If the measured rocker arm shaft run-out exceeds the specified limit, the rocker arm shaft must be replaced.













#### Rocker Arm Shaft Outside Diameter

Use a micrometer to measure the rocker arm fitting portion outside diameter.

If the measured value is less than the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Outside Diameter	
Standard	Limit
20.5 (0.807)	20.35 (0.801)



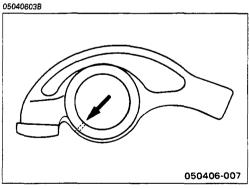
050406-006

#### Rocker Arm Shaft and Rocker Arm Clearance

 If the clearance between the rocker arm shaft inside diameter and the rocker arm shaft outside diameter (rocker arm fitting position diameter) exceeds the limit, the rocker arm and the rocker arm shaft must be replaced.

Rocker Arm and Rocker Arm Shaft

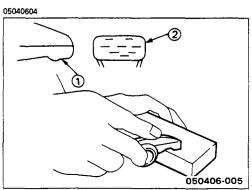
Clearance	mm(ir	
Standard	Limit	
0.005-0.045 (0.002-0.0018)	0.2 (0.008)	





2. Check that the rocker arm oil port is free of obstructions.

If necessary, use compressed air to clean the rocker arm oil port.





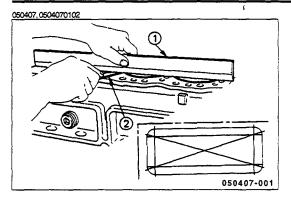
#### **Rocker Arm Correction**

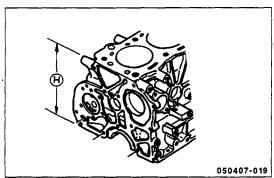
Inspect the rocker arm valve stem contact surfaces for step wear ① and scoring ②.

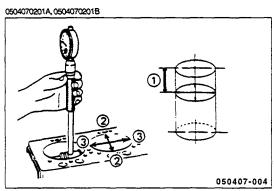
If the contact surfaces have light step wear or scoring, they may be honed with an oil stone.

If the step wear or scoring is severe, the rocker arm must be replaced. ,

mm(in)







#### CYLINDER BODY

#### Cylinder Body Upper Face Warpage

Cylinder Body Upper Face Warpage

Use a straight edge ① and a feeler gauge ② to measure the four sides and the two diagonals of the cylinder body upper face.

If the measured value is more than the limit, the cylinder body must be replaced.

Standard	Limit	
0.05 or less	0.2 (0.008)	
Cylinder Body Height() (R	eference) mm(in)	
St	andard	
4ZC1	214.5 (8.445)	
4ZE1	237.0 (9.390)	

#### Note:

Never attempt to regrinding the cylinder body if the upper face warpage exceeds the limit.

#### **Cylinder Bore Measurement**

Use a cylinder indicator to measure the cylinder bore at measuring point ① in the thrust ② - ② and axial ③ - ③ directions of the crankshaft.

Measuring Point ①: Approximately 10 mm (0.39 in)

If the measured value exceeds the specified limit, the cylinder must be rebored.

Cylinder Bore		mm(in)
	Standard	Limit
4ZC1	88.0 (3.465)	88.2 (3.472)
4ZE1	92.6 (3.645)	92.8 (3.653)

If there is scarring or scorching, the cylinder must be rebored.

Refer to "Cylinder Reboring Procedure".

If the measured cylinder bore exceeds the boring limit, the cylinder body must be replaced.

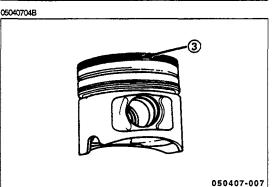
Boring Limit		mm(in)
4ZC1	89.04 (3.506)	
4ZE1	93.640 (3.6860)	

#### **Cylinder Reboring**

If even one cylinder measurement exceeds the specified limit, all the cylinders must be rebored. Never rebore only one cylinder.

Step wear and carbon deposits on the upper portion of the cylinder wall can be removed with a ridge reamer before reboring.

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#### **Cylinder Reboring Procedure**

- 1. Preparation
  - (1) Oversize Piston Selection

Measure each cylinder bore.

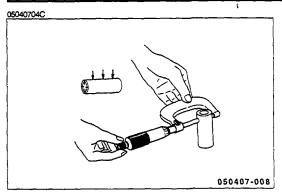
Measuring Point ①: 10 mm (0.39 in) Measuring Point ②: 70 mm (2.76 in)

Oversize pistons are available in two sizes. Select the correct size after determining the largest cylinder bore.

iston Ov	ersize (Reference)	mm(in)
	Standard	Limit
4ZC1	88.445-88.464 (3.4821-3.4828)	88.945-88.965 (3.5018-3.5026)
4ZE1	93.065-93.105 (3.6639-3.6655)	93.565-93.605 (3.6836-3.6852)

Oversize pistons have the "O/S" mark 3 at the topland.

Rebore the cylinders to fit the selected oversize piston outside diameter.



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Cylinder Bore Selection (2)

> Measure the outside diameter of the selected oversize pistons at measuring point (at a right angle to the piston pin).

Piston Measuring Point: 40 mm (1.57 in: 4ZC1)

40 mm (1.57 in: 4ZE1)

Formula

Boring inside diameter = P + C - H

P = Piston outside diameter

(Measured Oversize Piston)

Piston and cylinder bore clearance

Piston and Cylinder Bore Clearance mm(		mm(in)
4ZC1	0.035-0.055 (0.0014-0	.0022)
4ZE1 0.025-0.045 (0.0010-0.0018)		.0018)

Honing allowance H =0.03 (0.0012) or less

Reboring

Refer to "Cylinder Reboring".

3. Honing

All cylinders must be honed after reboring.

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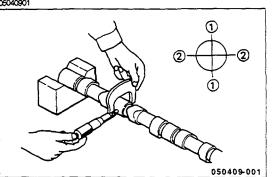
#### **CAMSHAFT**

Visually inspect the journals, the cams, the distributor drive gear, and the rocker arm shaft bracket for excessive wear and damage. The camshaft, the rocker arm shaft bracket, and the cylinder head must be replaced if these conditions are discovered during inspection.

#### Note:

The camshaft, the rocker arm shaft bracket, and the cylinder head must always be replaced as a set.





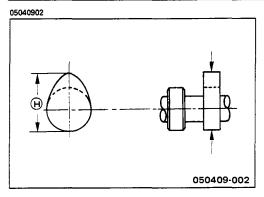


#### Camshaft Journal Diameter

Use a micrometer to measure each camshaft journal diameter in two directions (1) and 2). If the measured value is less than the specified limit, the camshaft must be replaced.

Camshaft Journal Diameter	mm(in)

Standard	Limit
33.940 - 33.955	33.900 (1.334)
(1.336 – 1.337)	

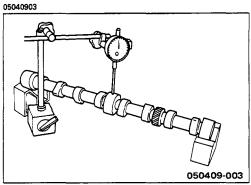




#### **Cam Height**

Measure the cam height  $\widehat{\mathbb{H}}$  with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Cam Height (H)	mm(in)	
Standard	Limit	
36.9 (1.45)	36.4 (1.43)	

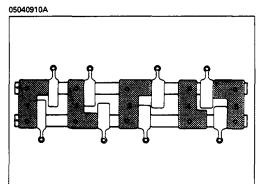




#### **Camshaft Run-Out**

- 1. Mount the camshaft on V-blocks.
- Measure the run-out with a dial indicator.If the measured value exceeds the specified limit, the camshaft must be replaced.

Camshaft Run-Out	mm(in)
Standard	Limit
0.05 (0.002)	0.10 (0.004)

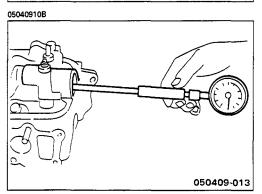




## Camshaft Journal and Rocker Arm Shaft Bracket Clearance

1. Install the rocker arm shaft bracket to the cylinder head and tighten it to the specified torque.

Rocker	Arm Shaft Bracket Nut Torque	kg-m(lb.ft/N-m)
<del>-</del>	Standard	
	2.2 ± 0.25 (16.0 ± 1.8/21.5 ±	2.5)
	200	





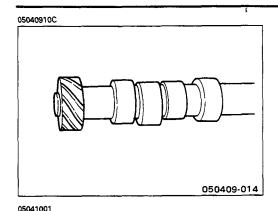
2. Use an inside dial indicator to measure the rocker arm shaft bracket inside diameter.

Rocker Arm Shaft Bracket Inside Diameter	mm(in)
Standard	
34.020 — 34.050 (1.3394 — 1.3405)	

If the clearance between the rocker arm shaft bracket inside diameter and the journal exceeds the specified limit, the camshaft and/or the cylinder head must be replaced.

# Camshaft Journal and Rocker Arm Shaft Bracket Clearance mm(in)

Clearance	11111/111	
Standard	Limit	
0.065 — 0.110 (0.0026 — 0.0043)	0.150 (0.006)	





#### **Distributor Drive Gear**

#### **Drive Gear Inspection**

Visually inspect the drive gear for excessive wear and damage.

If excessive wear or damage is discovered during inspection, the camshaft must be replaced.

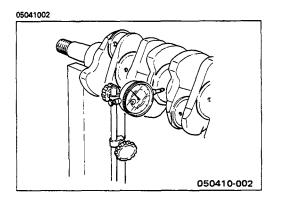


#### CRANKSHAFT AND BEARING

Inspect the surface of the crankshaft journals and crankpins for excessive wear and damage.

Inspect the oil seal fitting surfaces for excessive wear and damage.

Inspect the oil ports for obstructions.



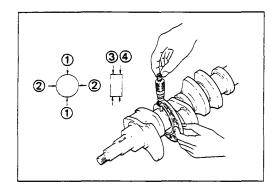


#### **Crankshaft Run-Out**

- Set a dial indicator to the center of the crankshaft journal.
- 2. Gently turn the crankshaft in the normal direction of rotation.

Read the dial indicator as you turn the crankshaft. If the measured value exceeds the specified limit, the crankshaft must be replaced.

Crankshaft Run-Out	mm(in)	
Standard	Limit	
0.03 (0.012) or less	0.10 (0.004)	





#### **Crankshaft Journal and Crankpin Diameter**

Crankshaft Journal Diameter

48.925 - 48.940

(1.9262 - 1.9268)

- Use a micrometer to measure the crankshaft journal diameter across points ① – ① and ② – ②.
- 2. Use the micrometer to measure the crankshaft journal diameter at the two points (3 and 4).
- Repeat Steps 1 and 2 to measure the crankpin diameter.

If the measured values are less than the specified limit, the crankshaft must be reground or replaced.

mm(in)

48.425 (1.9065)

Standard Limit		
55.920 — 55.935 (2.2016 — 2.2022)	55.420 (2.1819)	
Crankpin Diameter	mm(in	
Standard	Limit	

Crankshaft Journal and Crankpin Uneven Wear	mm(in)
Limit	
0.05 (0.002)	

#### **Crankshaft Bearing Selection**

Crankshaft bearing selection is based on the measured diameters of the crankshaft journals and the bearing housings.

Match the crankshaft bearing housing grade marks and the crankshaft journal grade marks in the table below to determine the correct crankshaft bearing size.

# 

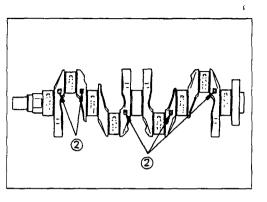
#### **Crankshaft Bearing Housing Grade Mark**

Crankshaft bearing housing grade marks 1 or 2 are stamped on the rear left-hand side of the cylinder body.

Example:



mm(in)



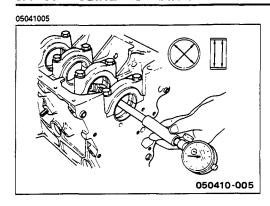
#### Crankshaft Journal Grade Mark

The crankshaft journal grade marks (1 or 2) are stamped on each crankshaft journal wave.

The crankshaft journal and bearing clearance must be the same for each position after installation of the crankshaft and the crankshaft bearings.

#### **Crankshaft Bearing Selection Table**

					mm(in.)
	Cylinder Body	Crankshaft Journal		Cranksha	ft Bearing
① Size Mark	Cylinder Body Journal Diameter	② Size Mark	Diameter	Thickness	Size Mark (Upper & Lower)
1	59.990-60.000	or 2	55.920—55.927 (2.2016—2.2018)	2.015—2.019 (0.0793—0.0795)	Blue
ľ	(2.3618—2.3622)	— or 1	55.928—55.935 (2.2019—2.2022)	2.011-2.015 (0.0792-0.0793)	Black
2	59.980-59.989	or 2	55.920—55.927 (2.2016—2.2018)		
2	(2.3614—2.3618)	— or 1	55.928—55.935 (2.2019—2.2022)	2.007—2.011 (0.0790—0.0792)	Brown
Under size 0.25	59.980-60.000		55.670—55.685 (2.1917—2.1923)	2.123—2.135 (0.0836—0.0841)	Stamp of size
Under size 0.50	(2.3614—2.3622)		55.420—55.435 (2.1819—2.1825)	2.248—2.260 (0.0885—0.0890)	Stamp of size





#### Crankshaft Journal and Bearing Clearance

If the clearance between the measured bearing inside diameter and the crankshaft journal diameter exceeds the specified limit, the crankshaft must be reground and undersize bearing installed or replaced.

Crankshaft Journal and Bearing Clearance	
Standard	Limit
0.023 — 0.050 (0.0009 — 0.0020)	0.12 (0.0047)



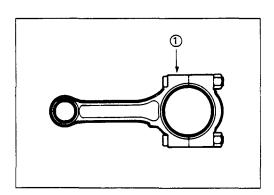


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#### **Connecting Rod Bearing Selection**

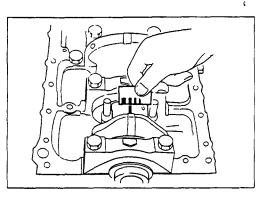
Refer to the following table when installing or replacing the connecting rod bearings.

Pay close attention to the connecting rod big end grade mark ①.



#### **Connecting Rod Bearing Selection Table**

•	J			mm(ii
O Sina Manta	Big end Bore	Crankshaft	Connecting R	
① Size Mark	Diameter	Pin Diameter	Thickness	Size Mark
A	51.996—52.000 (2.0471—2.0472)		1.509—1.513 (0.0594—0.0596)	Blue
В	51.988-51.995 (2.0468-2.0470)	48.925—48.940 (1.9262—1.9268)	1.505—1.509 (0.0592—0.0594)	Black
С	51.983—51.987 (2.0466—2.0467)		1.501—1.505 (0.0591—0.0592)	Brown
Under Size 0.25	51.983—52.000	48.675—48.690 (1.9163—1.9169)	1.623—1.635 (0.0639—0.0644)	Stamp of
Under Size 0.50	(2.0466—2.0472)	48.425—48.440 (1.9065—1.9071)	1.748—1.760 (0.0688—0.0693)	Size Mark





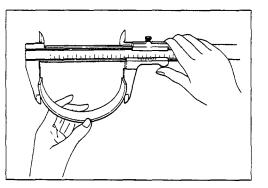
#### Crankpin and Bearing Clearance

If the clearance between the bearing inside diameter and the crankpin is greater than the standard but less than the limit, the crankshaft is serviceable.

If the clearance exceeds the limit, the crankshaft must be either reground or replaced.

If the crankshaft is reground, undersize bearings must also be installed.

Crankpin and Bearing Clearand	cemm(in)
Standard	Limit
0.030 — 0.060 (0.0012 — 0.0023)	0.12 (0.0047)



#### **Bearing Spread**

Use a vernier caliper to measure the bearing spread. If the measured value is less than the specified limit, the bearing must be replaced.

Bearing Spread	mm(ir	
	Limit	
Crankshaft Bearing	59.25 (2.333)	
Connecting Rod Bearing	52.25 (2.057)	

Check the bearing play.

#### **Crankshaft Regrinding**

To ensure crankshaft reliability, pay close attention to the following items during and after the crankshaft journal and crankpin regrinding procedure.

Undersize Bearing Availability		mm(in)
0.25 (0.01) 8	<u>ዩ</u> 0.50 (0.02)	
Crankshaft Journal and Cran (Reference)	kpin Grinding Limit	mm(in)
	kpin Grinding Limit 55.435 (2.182	

#### **Crankshaft Regrinding Procedure**

- 1. Regrind the crankshaft journals and the crankpins.
- 2. Fillet the crankshaft journal radiuses to a minimum of R  $2.7 \pm 0.2$  mm  $(0.1063 \pm 0.0079 \text{ in})$ .

There must be no stepping around the fillet area.

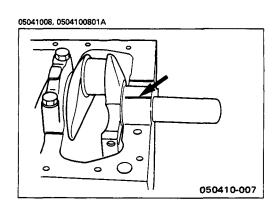
3. Finish the crankshaft journals, the crankpins, and the oil port corners to a smooth surface having a chamfer radius of 1 mm (0.04 in).

Crankshaft Journal and Crankpin Roughness mm(in)
0.001 (0.00004) or less

4. Check the crankshaft journal and crankpin clearance.

Refer to "Crankshaft Journal and Bearing Clearance" and "Crankpin and Bearing Clearance".

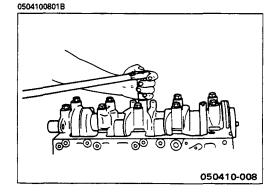
Check the crankshaft run-out.Refer to "Crankshaft Run-Out".





# Clearance Measurements (With Plastigage) Crankshaft Journal and Bearing Clearance

- Clean the cylinder body, the journal bearing fitting surface, the bearing caps, and the bearings.
- 2. Install the bearings to the cylinder body.
- 3. Carefully place the crankshaft on the bearings.
- 4. Rotate the crankshaft approximately 30° to seat the bearing.
- Place the Plastigage (arrow) over the crankshaft journal across the full width of the bearing.
- 6. Install the bearing caps with the bearing.



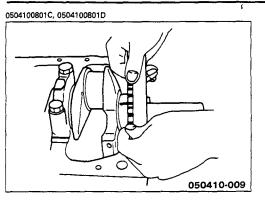


7. Tighten the bearing caps to the specified torque.

Crankshaft Bearing Cap Bolt Torque kg-m(lb.ft/N·m)  $10.0 \pm 1.5 (72.3 \pm 10.8/98.0 \pm 14.7)$ 

Do not allow the crankshaft to turn during bearing cap installation and tightening.

Remove the bearing cap.





9. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

If the measured value exceeds the limit, perform the following additional steps.

- Use a micrometer to measure the crankshaft outside diameter.
- 2) Use an inside dial indicator to measure the bearing inside diameter.

If the crankshaft journal and bearing clearance exceeds the limit, the crankshaft and/or the bearing must be replaced.

Crankshaft Journal and Bearing	ng Clearance mm(in)
Standard	Limit
0.023 — 0.050 (0.0009 — 0.0020)	0.12 (0.0047)

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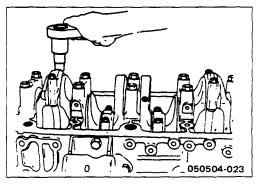
#### Crankpin and Bearing Clearance

- Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
- 2. Install the bearing to the connecting rod and the bearing cap.

Do not allow the crankshaft to move when installing the bearing cap.

- 3. Prevent the connecting rod from moving.
- 4. Attach the Plastigage to the crankpin.

Apply engine oil to the Plastigage to keep it from falling.





5. Install the bearing cap and tighten it to the specified torque.

Do not allow the connecting rod to move when installing and tightening the bearing cap.

Connecting Rod Bearing Cap Bolt

Torque		kg·m(lb.ft/N·m)
4ZC1/4ZD1/4ZE1	6.0±0.2 (43.4	±1.4/58.9±2.0)

Remove the bearing cap.

7. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

If the measured value exceeds the specified limit, perform the following additional steps.

- Use a micrometer to measure the crankpin outside diameter.
- 2) Use an inside dial indicator to measure the bearing inside diameter.

If the crank pin and bearing clearance exceeds the specified limit, the crankshaft and/or the bearing must be replaced.

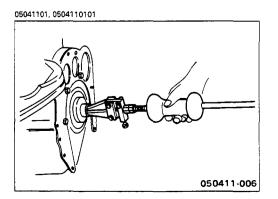
Crankpin and Bearing Cleara	nce mm(in)
Standard	Limit
0.030 — 0.060 (0.0012 — 0.0023)	0.12 (0.0047)

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#### **CRANKSHAFT PILOT BEARING**

Check the crankshaft pilot bearing for excessive wear and damage and replace it if necessary.



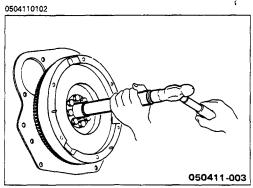


#### Crankshaft Pilot Bearing Replacement Crankshaft Pilot Bearing Removal



Use the pilot bearing remover to remove the crankshaft pilot bearing.

Pilot Bearing Remover: 5-8840-2000-0 (J-5822) Sliding Hammer: 5-8840-0019-0 (J-23907)



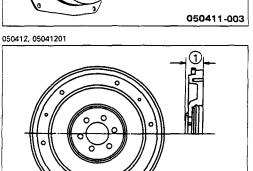


#### **Crankshaft Pilot Bearing Installation**

1. Place the crankshaft pilot bearing horizontally across the crankshaft bearing installation hole.

Tap around the edges of the crankshaft pilot bearing outer races with a brass hammer to drive the bearing into the crankshaft bearing installation hole.

Pilot Bearing Installer: 5-8522-0125-0 (J-26516-A)





050412-005

#### FLYWHEEL AND RING GEAR

#### Flywheel

- 1. Inspect the flywheel friction surface for excessive wear and heat cracks.
- 2. Measure the flywheel width.

If the measured value is between the standard and the specified limit, the flywheel may be reground.

If the measured value exceeds the specified limit, the flywheel must be replaced.

mm(in)
Limit
42.45 (1.671)
ess mm(in)
0.00024)
_

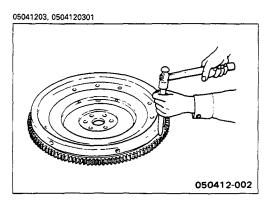
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#### Ring Gear

Inspect the ring gear.

If the ring gear teeth are broken or excessively worn, the ring gear must be replaced.

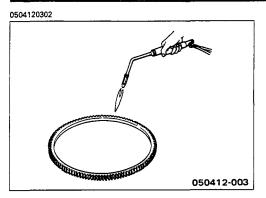




#### Ring Gear Replacement Ring Gear Removal

and chisel to remove it.

Strike around the edges of the ring gear with a hammer





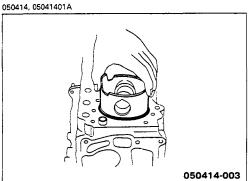
#### **Ring Gear Installation**

Heat the ring gear evenly with a gas burner to expand it.

Do not allow the temperature of the gas burner to exceed 200°C (390°F).

2. Install the ring gear when it is sufficiently heated.

The ring gear must be installed with the chamfer facing the clutch.

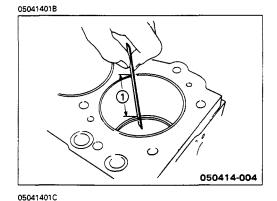




#### **PISTON RING**

#### **Piston Ring Gap**

 Insert the piston ring horizontally (in the position it would assume if it were installed to the piston) into the cylinder bore.





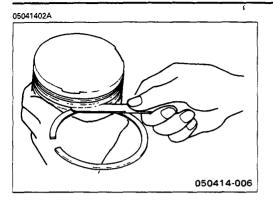
2. Push the piston ring into the cylinder bore until it reaches the point ① where the cylinder bore is the smallest.

Do not allow the piston ring to slant to one side or the other. It must be perfectly horizontal.

Measuring Point ①: 70 mm (2.76 in)

 Use a feeler gauge to measure the piston ring gap.
 If the measured value exceeds the specified limit, the piston ring must be replaced.

the piston ring must b	c replaced.	
Piston Ring Gap		mm( <u>in)</u>
	Standard	Limit
1st Compression Ring	0.30-0.45 (0.012-0.018)	
2nd Compression Ring	0.25—0.40 (0.010—0.016)	1.50 (0.059)
Oil Ring	0.20-0.70 (0.008-0.028)	





#### Piston Ring and Piston Ring Groove Clearance

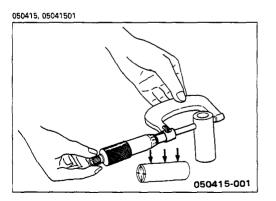


Use a feeler gauge to measure the clearance between the piston ring and the piston ring groove at several points around the piston.

If the clearance between the piston ring and the piston ring groove exceeds the specified limit, the piston ring must be replaced.

Piston Ring	and Piston	Ring	Groove	Clearance	mm(in)

Iston fing and riston fing droove clearance minim		
	Standard	Limit
1st Compression Ring	0.025-0.060 (0.0010-0.0024)	0.150 (0.0059)
2nd Compression Ring	0.020-0.055 (0.0008-0.0022)	0.150 (0.0059)





#### **PISTON PIN**

#### Piston Pin Diameter

Use a micrometer to measure the piston pin outside diameter at several points.

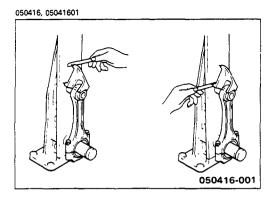
If the measured value is less than the specified limit, the piston pin must be replaced.

Piston Pin Diameter	Piston	Pin	Diameter
---------------------	--------	-----	----------

mm(in)

Stan	dard	Limit
4ZD1/4ZE1	22.997–23.005 (0.9054–0.9057)	22.970 (0.9043)
4ZC1	21.997–22.005 (0.8660–0.8663)	21.970 (0.8650)

#### **6A-88 ENGINE MECHANICAL**





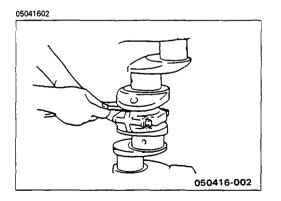
#### **CONNECTING ROD**

#### **Connecting Rod Alignment**

Use a connecting rod aligner to measure the distortion and the parallelism between the connecting rod big end hole and the connecting rod small end hole.

If either the measured distortion or parallelism exceed the specified limit, the connecting rod must be replaced.

Per Length of 100 mm (3.94 in)		mm(in)
	Standard	Limit
Distortion	0.05 (0.002)	0.20 (0.008)
Parallelism	0.05 or Less (0.002)	0.15 (0.006)





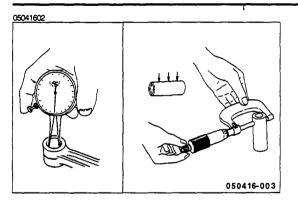
#### **Connecting Rod Side Face Clearance**

- 1. Install the connecting rod to the crankpin.
- Use a feeler gauge to measure the clearance between the connecting rod big end side face and the crankpin side face.

If the measured value exceeds the specified limit, the connecting rod must be replaced.

Connecting Rod Big End and Crankpin Side
Face Clearance mm(in)

Standard	Limit
0.20 - 0.33 (0.008 - 0.013)	0.35 (0.014)





## Piston Pin and Connecting Rod Small End Interference

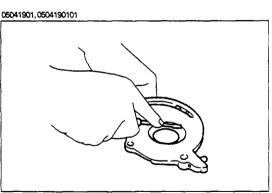
1. Use a calliper calibrator and a dial indicator to measure the connecting rod small end diameter.

Co	onnecting	Rod Small End Diameter	mm(in)
	4ZE1	22.964-22.977 (0.9041-0.904	6)
	4ZC1	21.964-21.977 (0.8647-0.865	2)

2. Determine the piston pin and connecting rod small end interference.

Piston Pin and Connecting Rod Small End Interference mm(in)

0.020 - 0.041	(0.008 -	0.0016)
---------------	----------	---------

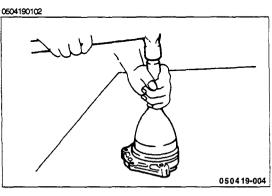




#### FRONT OIL SEAL RETAINER

Crankshaft Front Oil Seal Replacement Oil Seal Removal

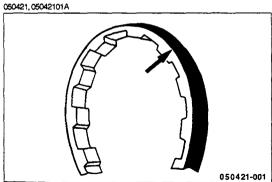
Use a screwdriver to pry the oil seal free from the front oil seal retainer.





#### Oil Seal Installation

Apply engine oil to new oil seal and install it using installer.



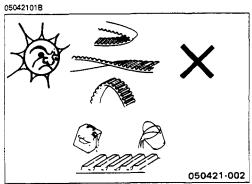


#### **TIMING BELT**

#### **Timing Belt Handling Precautions**

1. Do not bend the belt to a radius of less than 20 mm (0.79 in).

Do not violently twist or bend the belt. Doing so will damage the glass fibre imbedded in the belt. Timing belt precision will be adversely affected.



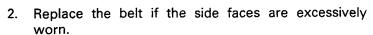
Do not store the belt in direct sunlight or in an area where it will be exposed to high temperatures.

Do not allow the stored belt to become dirty.

Do not use sharp metal tools to stretch or force the belt into position during installation.



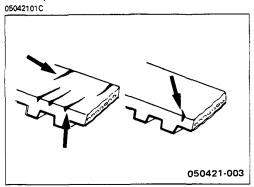
Replace the belt if cracks are found in the side and rear face gum.

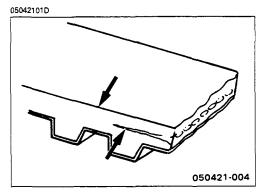


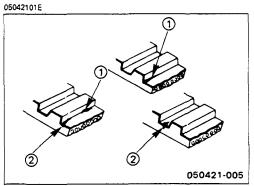
Check also for manufacturing defects, rounded belt edges, and loose glass fiber.

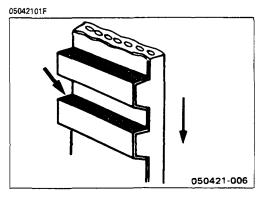
3. Replace the belt if the fabric is cracked ① or disintegrated 2.

Replace the belt if the cogs are excessively worn. Check the loaded side of the cogs for fuzzing, discoloration, and baldness.









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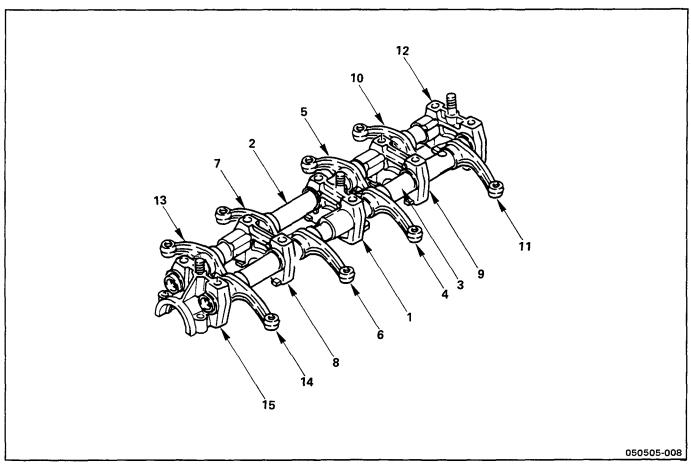


#### **INTERNAL PARTS**

#### MINOR COMPONENTS



#### **ROCKER ARM SHAFT AND ROCKER ARM**



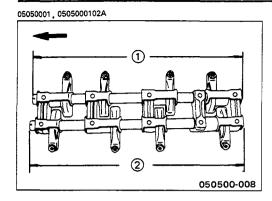
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#### **Reassembly Steps**

- ▲ 1. No. 3 rocker arm shaft bracket
- 2. Rocker arm shaft (Intake side)
- ▲ 3. Rocker arm shaft (Exhaust side)
- ▲ 4. No. 3 exhaust valve rocker arm
  - 5. No. 3 intake valve rocker arm
  - 6. No. 2 exhaust valve rocker arm
  - 7. No. 2 intake valve rocker arm
  - 8. No. 2 rocker arm shaft bracket

- 9. No. 4 rocker arm shaft bracket
- 10. No. 4 intake valve rocker arm
- 11. No. 4 exhaust valve rocker arm
- 12. No. 5 rocker arm shaft bracket
- 13. No. 1 intake valve rocker arm
- 14. No. 1 exhaust valve rocker arm
- 15. No. 1 rocker arm shaft bracket

#### 6A-92 ENGINE MECHANICAL





#### **Important Operations**

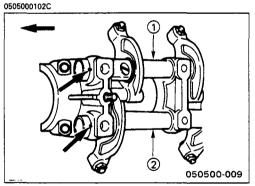




- 2., 3. Rocker Arm Shaft (Intake and Exhaust)
- 1) Apply a coat of engine oil to the rocker arm shafts, the shaft brackets, and the rocker arms.
- Install the shorter rocker arm shaft to the No. 3 bracket intake side.

The punch mark must be facing the front of the engine.

① Intake Side Shaft (1): 388 mm (15.28 in)

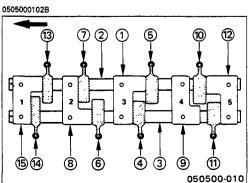




Install the longer rocker arm shaft to the No. 3 bracket exhaust side.

The punch mark must be facing the front of the engine.

2 Exhaust Side Shaft (2): 391 mm (15.40 in)

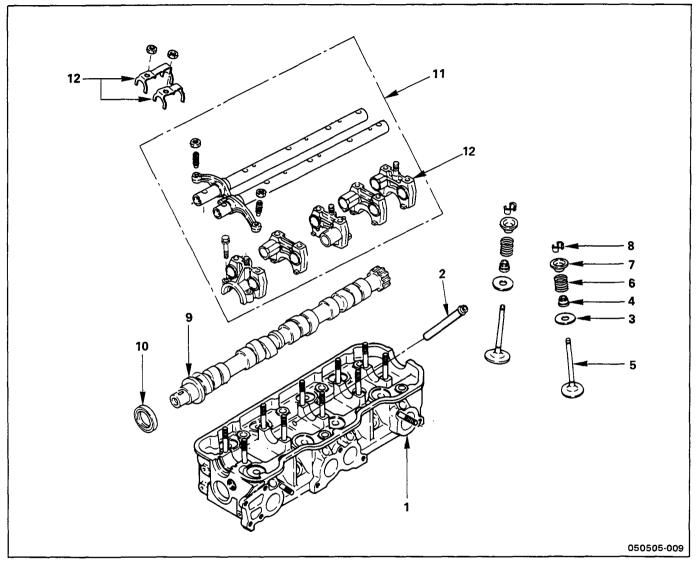


#### **Rocker Arm**

Install the brackets and the rocker arms to the rocker arm shafts in the sequence as shown in the illustration.



#### CYLINDER HEAD WITH ROCKER ARM SHAFT AND CAMSHAFT



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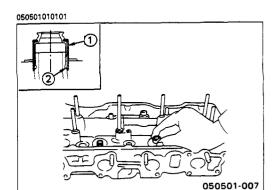
#### **Reassembly Steps**

- 1. Cylinder head
- 2. Fuel pump push rod
- 3. Valve spring lower seat
- ▲ 4. Valve stem oil seal
- ▲ 5. Intake and exhaust valve
- ▲ 6. Valve spring
  - 7. Valve spring upper seat

- ▲ 8. Split collar
- ▲ 9. Camshaft
- ▲ 10. Camshaft front oil seal
  - 11. Rocker arm shaft and rocker arm
- ▲ 12. Rocker arm shaft bracket nut and spring (No.1 No.4)



#### **Important Operations**



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#### 4. Valve Stem Oil Seal

- 1) Apply a coat of engine oil to the oil seal inner face.
- Carefully insert the oil seal ① to the valve guide ② groove.

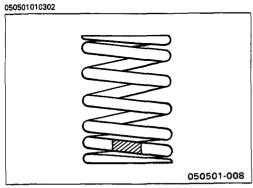
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#### 5. Intake and Exhaust Valve

- Apply a coat of engine oil to each valve stem before installation.
- 2) Install the intake and exhaust valves.
- 3) Turn the cylinder head up to install the valve springs.

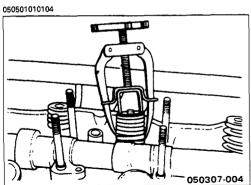
Take care not to allow the installed valves to fall free.





#### 6. Valve Spring

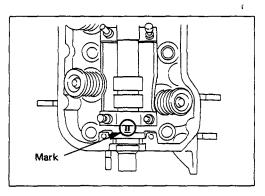
Install the valve spring with the fine pitched end (painted) facing down.





#### 8. Split Collar

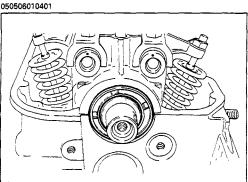
- Use the spring compressor to compress the valve spring into position.
  - Spring Compressor: 5-8840-0205-0 (J-26513-A)
- 2) Install the split collar to the valve stem.
- Set the split collar by tapping around the collar head with a rubber hammer.





#### 9. Camshaft

- 1) Apply engine oil to the cylinder head and camshaft journals.
- Set the camshaft to the cylinder head.
   The camshaft mark must be facing up.





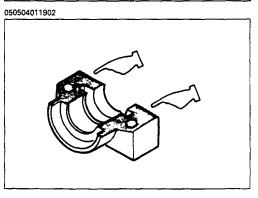
#### 10. Camshaft Front Oil Seal

1) Apply engine oil to the oil seal lip circumference.



2) Use the oil seal installer to install the oil seal.

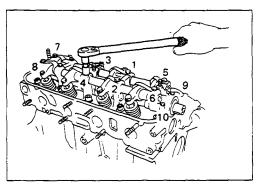
Oil Seal Installer: 5-8840-0144-0 (J-33183)





#### 12. Rocker Arm Shaft Bracket Nut and Spring

 Apply silicon gasket beforehand to the front side of the fitting surface of No. 1 rocker arm bracket with the cylinder head.





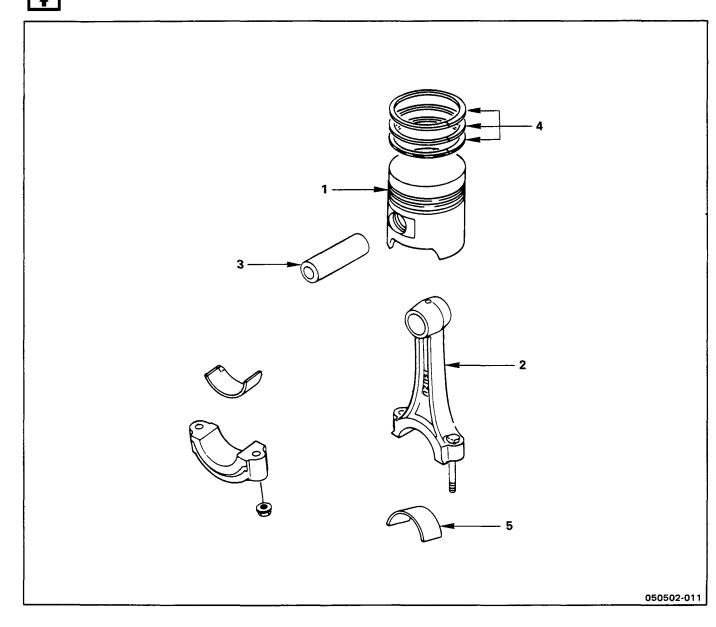
- 2) Apply engine oil to the rocker arm bracket stud bolts and nuts.
- 3) Tighten the rocker arm shaft bracket bolts in the numerical order shown in the illustration.

Rocker Arm Shaf	t Bracket Nut Torque	kg·m(lb.ft/N·m)
No. 1 — 8	$2.2 \pm 0.25$ (16.0 $\pm$	1.8/21.6 ± 2.5)
No. 9 & 10	0.75 ± 0.15 (4.3 ±	1.1/5.9 ± 1.5)

After assembly apply lubricate the rocker arm shaft and valves with engine oil.



#### **PISTON AND CONNECTING ROD**



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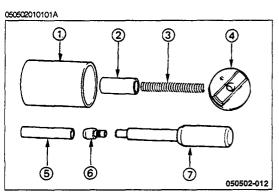
#### **Reassembly Steps**

- ▲ 1. Piston
- ▲ 2. Connecting rod
- ▲ 3. Piston pin

- ▲ 4. Piston ring
- ▲ 5. Connecting rod bearing



#### **Important Operations**





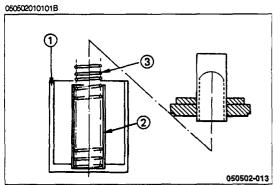
- 1. Piston
- 2. Connecting Rod
- 3. Piston Pin

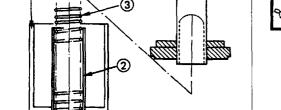
Piston Pin Replacement Using The Special Tool Piston Pin Replacer: 5-8840-0361-0 (4ZE1)

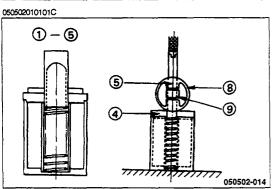
- ① Body
- ⑤ Installation
- ② Spring guide
- ® Removal guide
- 3 Spring
- ⑦ Driver handle
- Adapter

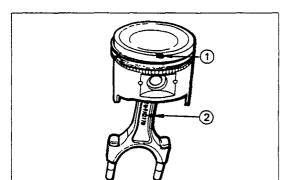
#### **Piston Pin Installation Procedure**

- 1) Apply a coat of engine oil to the piston pin, the piston, and the connecting rod.
- 2) Set the spring guide 2 and the spring 3 to the body ①.
- 3) Insert the installation guide (5) from the bottom of the adapter 4.
- 4) Set the adapter together with the installation guide to the top of the body.
- 5) Place the assembled tools ① ⑤ on a bench press.
- 6) Set the piston ® and the connecting rod 9 to the portion of the installation guide (5) protruding from the adapter  $\Phi$ .





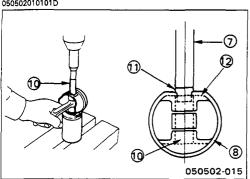


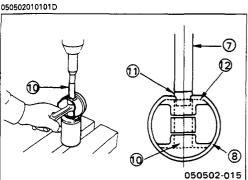


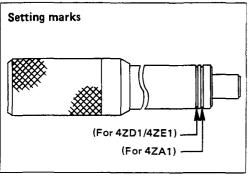


Align the piston head front mark ① and the connecting rod "ISUZU" casting mark 2. Both marks must be facing the same direction.



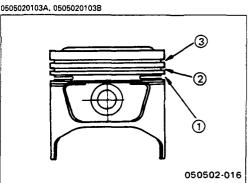


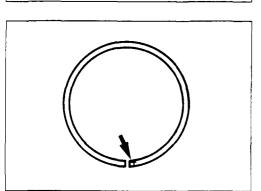






- Set the piston pin @ against the piston pin hole.
- Set the driver handle 7 against the piston pin.
- Use the bench press to slowly force the piston pin into the piston pin hole until the driver handle setting mark (1) is perfectly flush with the piston boss outside surface 12.
- 10) Check that the connecting rod moves smoothly.







Use a piston ring replacer to install the three piston rings.



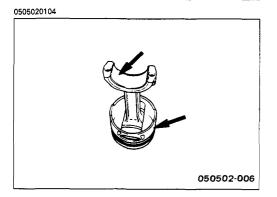
Install the piston rings in the order shown in the illustration.

- ① Oil ring
- 2 2nd compression ring
- 3 1st compression ring

#### Note:

Install the compression rings with the stamped side facing up. (1st ring is T, 2nd ring is 2T)

- 2) Apply engine oil to the piston ring surfaces.
- Check that the piston rings rotate smoothly in the piston ring grooves.



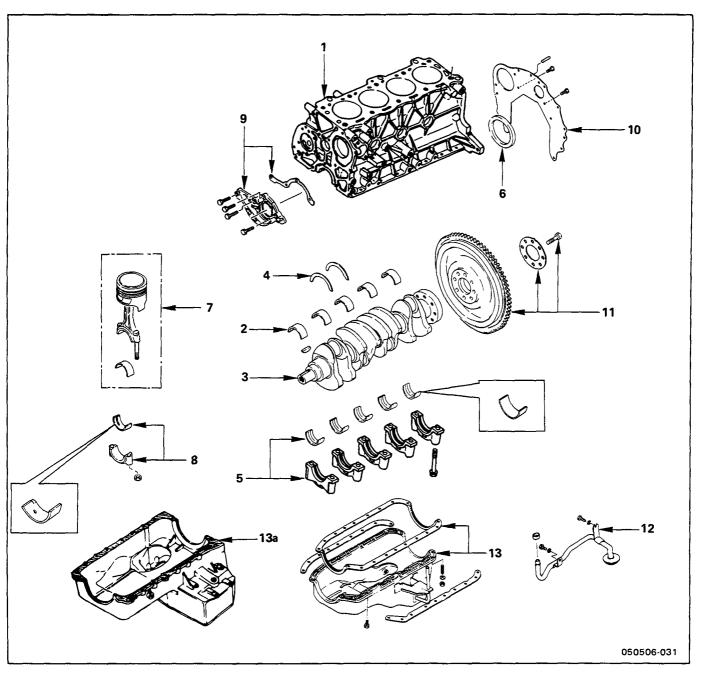


#### 5. Connecting Rod Bearing

Carefully wipe any oil or other foreign material from the connecting rod bearing back face and the connecting rod bearing fitting surface.



#### **MAJOR COMPONENTS**

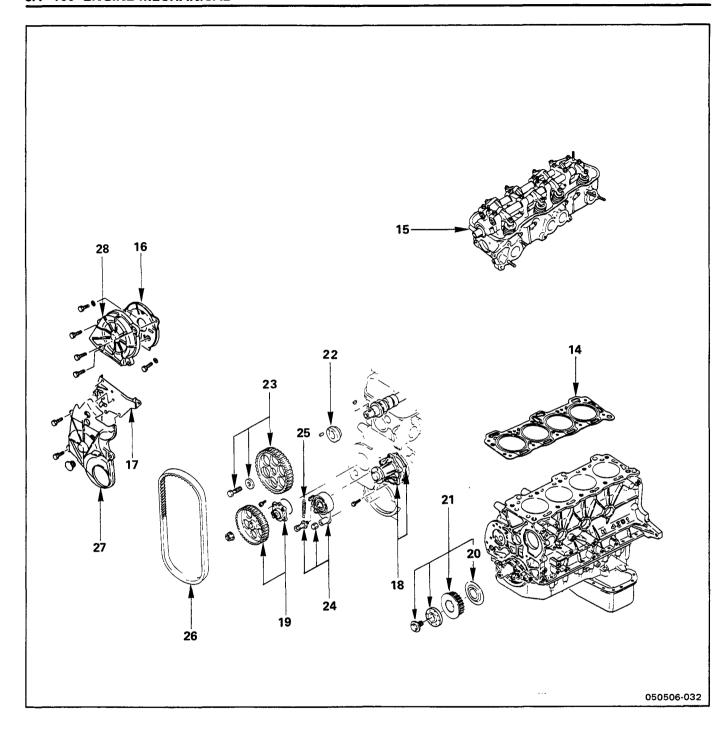


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#### **Reassembly Steps-1**

- ▲ 1. Cylinder body
- ▲ 2. Crankshaft upper bearing
- ▲ 3. Crankshaft
- ▲ 4. Crankshaft thrust bearing
- ▲ 5. Crankshaft bearing cap with lower bearing
- ▲ 6. Crankshaft rear oil seal
- ▲ 7. Piston and connecting rod with upper bearing
- ▲ 8. Connecting rod bearing cap with lower bearing
- ▲ 9. Crankshaft front oil seal retainer
- ▲ 10. Cylinder body rear plate
- ▲ 11. Flywheel
- ▲ 12. Oil pipe with strainer
- $\blacktriangle$  13. Oil pan (For 4  $\times$  2)
- $\blacktriangle$  13a. Oil pan (For 4  $\times$  4)

Inverted engine



0505060002D, 0505060002E

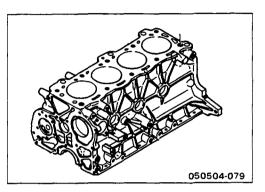
#### **Reassembly Steps-2**

- ▲ 14. Cylinder head gasket
- ▲ 15. Cylinder head with rocker arm shaft and camshaft
- ▲ 16. Cylinder head front plate (Upper)
- ▲ 17. Cylinder body front plate (Lower)
- ▲ 18. Water pump
- ▲ 19. Oil pump with timing pulley
- ▲ 20. Timing belt guide plate

- ▲ 21. Crankshaft timing pulley
  - 22. Camshaft boss
- ▲ 23. Camshaft timing pulley
- ▲ 24. Tension pulley
- ▲ 25. Tension spring
- ▲ 26. Timing belt
  - 27. Timing belt lower cover
  - 28. Timing belt upper cover



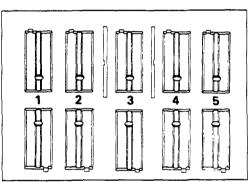
#### **Important Operations**





#### 1. Cylinder Body

Use compressed air to thoroughly clean the inside and outside surfaces of the cylinder body, the oil holes, and the water jackets.



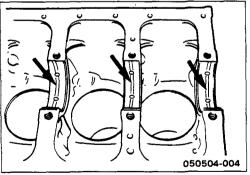


#### 2. Crankshaft Upper Bearing

Crankshaft bearings are selected according to cylinder body and crankshaft grade.

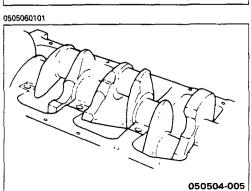
Refer to "INSPECTION AND REPAIR", "Crankshaft Bearing Selection".

 Carefully wipe any foreign material from the upper bearing.



#### Note:

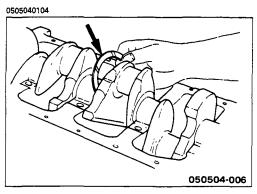
Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surfaces.





#### 3. Crankshaft

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft.



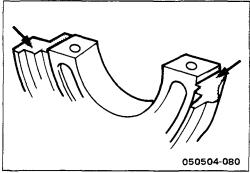
### 4. Crankshaft Thrust Bearing

Apply an ample coat of engine oil to the thrust bearings before installation.

Install the thrust bearings to the crankshaft center journal.

The thrust bearing oil grooves must be facing the sliding faces.





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#### Crankshaft Bearing Cap with Lower Bearing

Apply the recommended liquid gasket or its equivalent to the cylinder body fitting surfaces of the No. 5 crankshaft bearing cap.

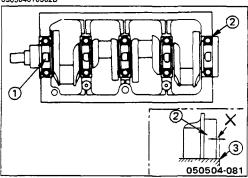
#### Note:

Lower bearing are as follows;

4ZE1 engine without oil groove of bearing.

4ZC1/4ZD1 engine with oil groove of bearing.





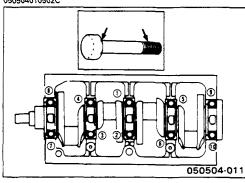


2) Install the bearing caps with the bearing cap head mark ① facing forward.

#### Note:

The No. 5 bearing cap ② must be perfectly flush with the cylinder body rear face ③.





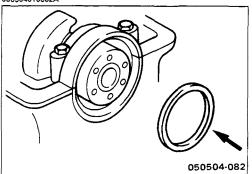


- 3) Apply a coat of engine oil to the bearing cap bolts.
- 4) Tighten the bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

Crankshaft Bearing Cap Bolt Torque kg-m(lb.ft/N-m)  $10.0 \pm 1.5 (72.3 \pm 10.5/98.0 \pm 14.7)$ 

 Check to see that the crankshaft turns smoothly by rotating it manually.

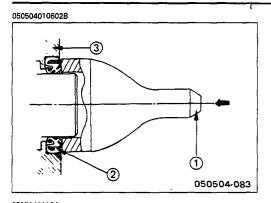






#### 6. Crankshaft Rear Oil Seal

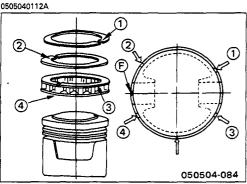
 Apply engine oil to the oil seal lip circumference and the oil seal outer circumference.





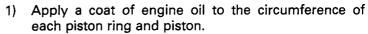
Use the oil seal installer 1 to install the oil seal 2 2) to the cylinder body 3.

Oil Seal Installer: 5-8840-2286-0 (J-39201)





- Piston and Connecting Rod with Upper Bearing 7.
- 8. Connecting Rod Bearing Cap with Lower Bearing



- 2) Position the piston ring gaps as shown in the illustration.
  - 1 1st compression ring
  - 2 2nd compression ring
  - Oil ring (Upper side rail)
  - Oil ring (Lower side rail)

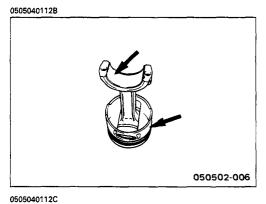


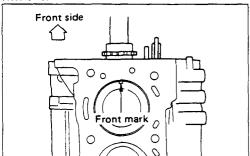
Apply a coat of molybdenum disulfide grease to the 3) two piston skirts.



This will facilitate smooth break-in when the engine is first started after reassembly.

- Apply a coat of engine oil to the upper bearing surfaces.
- 5) Apply a coat of engine oil to the cylinder wall.







6) Position the piston head front mark so that it is facing the front of engine.



7) Use the piston ring compressor to compress the piston rings.

Piston Ring Compressor: 5-8840-9018-0 (J-8037)

8) Use a hammer grip to push the piston in until the connecting rod makes contact with the crankpin.

At the same time, rotate the crankshaft until the crankpin is at BDC.



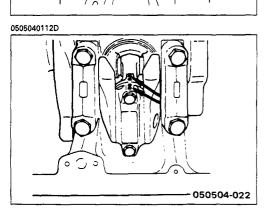
Install the connecting rod bearing caps.

Align the bearing cap cylinder number marks and the connecting rod cylinder number marks.



Note:

Lower bearing are as follows: 4ZE1 engine without oil groove of bearing. 4ZC1/4ZD1 engine with half oil groove of bearing.



#### 6A-104 ENGINE MECHANICAL

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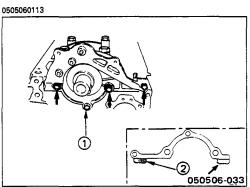
10) Apply a coat of engine oil to the threads and setting faces of each connecting rod cap bolt.



11) Tighten the connecting rod caps to the specified torque.

Connecting Rod Bearing Cap Bolt

Torque		kg·m(lb.ft/N·m)
4ZC1/4ZD1/4ZE1	M10	6.0±0.2 (43.4±1.5/58.8±2.0)



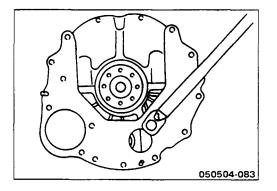


#### 9. Crankshaft Front Oil Seal Retainer

- 1) Apply engine oil to the oil seal lip circumference and the oil seal outer circumference.
- 2) Apply the recommended liquid gasket or its equivalent to the oil seal retainer gasket.
- 3) Tighten the oil seal retainer bolts ① to the specified torque.

Oil Seal Retainer Bolt	Torque	kg-m(lb.ft/N-m
1.9 ± 0.5	$(13.7 \pm 3.6)^{\circ}$	18.6 ± 4.9)

4) Cut away any gasket protruding ② from the area where the oil pan is to be installed.





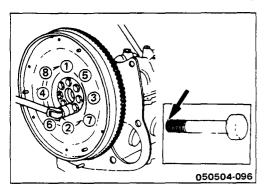
#### 10. Cylinder Body Rear Plate



Install the rear plate to the cylinder body.
Align the rear plate with the cylinder body knock pin.

2) Tighten the rear plate bolts to the specified torque.

Rear Plate Bolt Torque	kg·m(lb.ft/N·m)
$5 \pm 1 (36.2 \pm 7.2/49.0)$	) ± 9.8)





#### 11. Flywheel

- 1) Apply the LOCTITE or its equivalent to the new bolts.
- 2) Block the crankshaft with a piece of hard wood to prevent it from turning.
- 3) Tighten the flywheel bolts in the numerical order shown in the illustration.

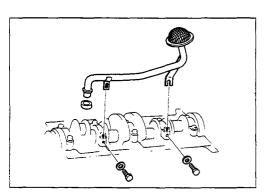
Flywheel Bolt Torque

kg·m(lb.ft/N·m)

 $6.0 \pm 0.5$  (43.4  $\pm$  3.6/58.8  $\pm$  4.9)

#### Note:

When reinstalling the crankshaft which has been in use, remove all traces of LOCTITE from the bolt holes in the crankshaft by turning in the new bolt, then clean the crankshaft with cleaner before installing the flywheel.





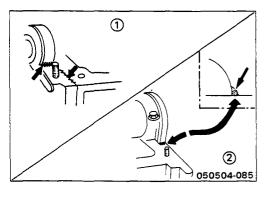
#### 12. Oil Pipe with Strainer

- 1) Install the rubber hose to the oil pipe.
- 2) Install the oil pipe to the bearing caps.
- 3) Tighten the oil pipe bolts to the specified torque.

Oil Pipe Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

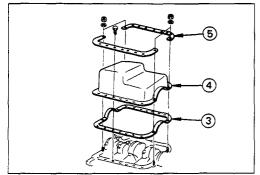
 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 





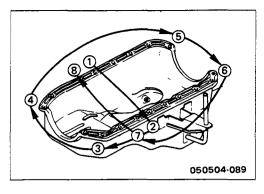
#### 13. Oil Pan (For $4 \times 2$ )

- 1) Apply the recommended liquid gasket or its equivalent to the gap between the oil seal retainer and the cylinder body at the positions shown in the illustration ①.
- 2) Apply the recommended liquid gasket or its equivalent to the No. 5 bearing cap at the positions shown in the illustration ②.





- 3) Install the oil pan gasket ③ and the oil pan ④ to the cylinder body.
- Install the damper plates (5) to the oil pan.
   The damper plate rubber side must be oil pan side.



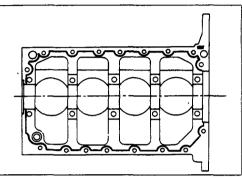


Tighten the oil pan bolts and nuts to the specified torque a little at a time in the sequence shown in the illustration.

Oil Pan Bolt and Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

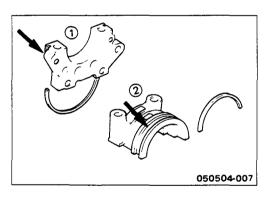
 $0.5 \pm 0.1 \ (3.6 \pm 0.7/4.9 \pm 1.0)$ 





#### 13a. Oil Pan (For $4 \times 4$ )

Apply the recommended liquid gasket or its equivalent to the oil pan fitting surfaces of the cylinder body.



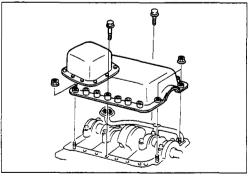


Install an arch gasket to both the No. 1 1 and the No. 5 @ crankshaft bearing caps.

Apply liquid gasket to the end of the arch gasket.

Use your fingers to push the arch gasket into the groove.

Take care not to scratch the outer surface of the arch gasket.



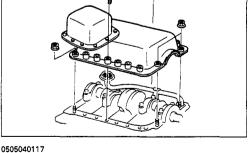


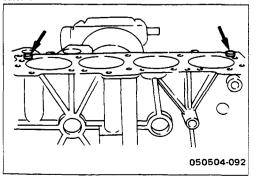
Tighten the oil pan bolts and nuts to the specified torque a little at a time.

Oil Pan Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.8 \pm 0.5 (13.0 \pm 3.6/17.6 \pm 4.9)$ 





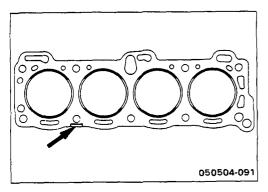


#### 14. Cylinder Head Gasket

Clean the cylinder body upper side and the cylinder head lower side and attach the dowels.

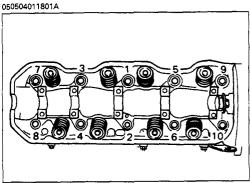






2) Install the gasket with the "TOP" mark facing up and to the front.

Align the cylinder head dowels and the cylinder head gasket holes.



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# 15. Cylinder Head with Rocker Arm Shaft and Camshaft



1) Apply a coat of engine oil to the cylinder head bolt threads and setting faces.



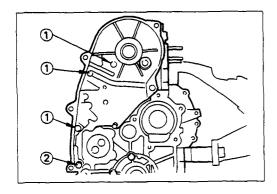
2) Use the cylinder head bolt wrench to tighten the cylinder head bolts to the specified torque.



Follow the numerical sequence shown in the illustration.

Head Bolt Wrench: 9-8511-4209-0 (J-2423-01)

Cylinder Head Bolt	Forque kg⋅m(lb.ft
1st Step	2nd Step
8 (57.8/78.4)	$10 \pm 1 (72.3 \pm 7.2/98.0 \pm 9.8)$



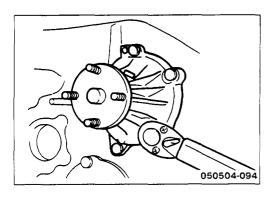


#### 16. Cylinder Head Front Plate

#### 17. Cylinder Body Front Plate

- Install the cylinder head front plate to the cylinder head.
- 2) Install the cylinder body front plate to the cylinder body.
- 3) Tighten the front plate bolts to the specified torq

Front Plate Bolt Torque	kg·m(lb.ft/N·m)
① M6 × 1.0 (4T)	$0.6 \pm 0.2 \ (4.3 \pm 1.4/5.9 \pm 2.0)$
② M8 × 1.25 (4T)	$1.3 \pm 0.5 \ (9.4 \pm 3.6/9.8 \pm 4.9)$

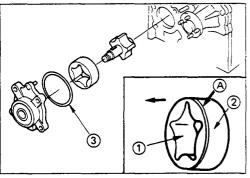




#### 18. Water Pump

Tighten the water pump bolts to the specified torque.

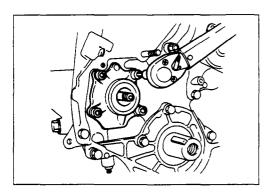
righten the realer pains a constant	
Water Pump Bolt Torque	kg·m(lb.ft/N·m)
$2.7 \pm 0.5 \ (19.5 \pm 3.6)$	/26.5 ± 4.9)
Water Pump Nut Torque	kg·m(lb.ft/N·m)
$1.9 \pm 0.5 (13.7 \pm 3.6)$	/18.6 + 4.9)





#### 19. Oil Pump and Timing Pulley

- 1) Apply engine oil to the cylinder body outer rotor fitting surfaces and the inner ① and the outer ② rotor.
- 3) Install the O-rings 3 to the oil pump body.



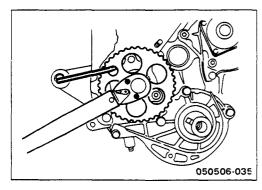


4) Install the oil pump assembly to the cylinder body. **Note**:

# Take care not to twist the O-rings during the installation procedure.

5) Use the inner hexagon wrench to tighten the oil pump bolts to the specified torque. Inner Hexagon Wrench: 6 mm (0.24 in)

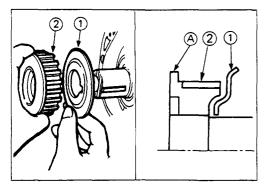
Oil Pump Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5	$(13.7 \pm 3.6/18.6 \pm 4.9)$





- 6) Check that the oil pump rotor turns smoothly.
- 7) Install the timing pulley to the oil pump.
- 8) Apply the LOCTITE or its equivalent to the pulley nut.
- 9) Tighten the timing pulley nut to the specified torque.

Timing Pulley Nut Torque	kg·m(lb.ft/N·m)
7.7 ± 1.0 (55.7 ±	7.2/75.5 ± 9.8)

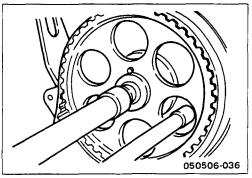




#### 20. Timing Belt Guide Plate

#### 21. Crankshaft Timing Pulley

Install the crankshaft timing pulley with the guide plate ① projecting side facing the timing pulley ② and the timing pulley flanged portion ④ facing forward.



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#### 23. Camshaft Timing Pulley

Tighten the camshaft timing pulley bolts to the specified torque.

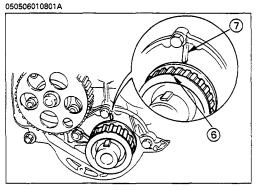
Camshaft Timing Pulley Bolt Torque kg·m(lb.ft/N·m)  $6.0 \pm 0.5 (43.4 \pm 3.6/58.8 \pm 4.9)$ 

#### 24. Tension Pulley

#### 25. Tension Spring

- 1) Install the tension pulley ① to the tension stud ②.
- 2) Install the tension spring 3.
- 3) Using the tension stud ② as a fulcrum, push the tension pulley ① as far as possible in the direction of the water pump ④.
- 4) Temporarily tighten the tensioner bolt ⑤.

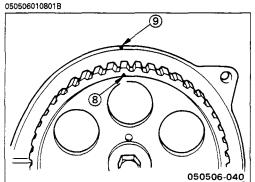
  The bolt must be tightened enough to hold the spring in place.





#### 26. Timing Belt

1) Align the crankshaft timing pulley mark 6 with the oil seal retainer setting mark 7.

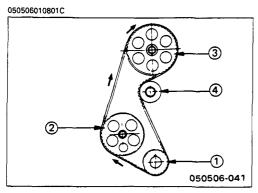




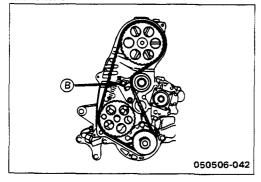
Check that the camshaft timing pulley setting mark
 and the front plate setting mark
 are aligned.

#### Note:

At this point the No. 4 cylinder comes to its compression, top dead center.



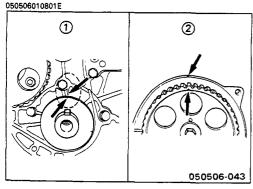
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3) Install the timing belt to the crankshaft timing pulley ①, the oil pump timing pulley ②, the camshaft timing pulley ③, and the tension pulley ④ in that order.

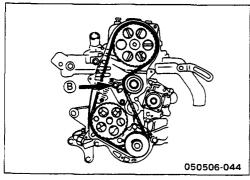
#### Note:

- 1) Take care not to twist the timing belt.
- 2) Be sure that the timing belt cleanly fits over the pulley gear teeth.
- 4) Loosen the tensioner bolt ®.
- 5) Allow the tension spring to pull the timing belt as far as possible.
- 6) Once again, temporarily tighten the tensioner bolt (B).



- 7) Rotate the crankshaft counterclockwise two full turns (720°).
  - ① Check that the crankshaft timing pulley mark is aligned with the oil seal retainer setting mark.
  - ② Check that the camshaft timing pulley setting mark is aligned with the front cover setting mark.







- 8) Loosen the tensioner bolt "B".
- 9) Allow the tension spring to pull the timing belt as far as possible.
- 10) Tighten the tensioner bolt "B" to the specified torque.

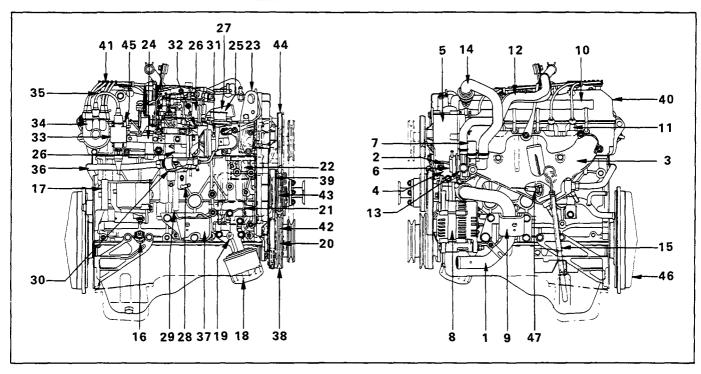
Tensioner Bolt "B" Torque

kg·m(lb.ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 



#### **EXTERNAL PARTS**



#### **Reassembly Steps**

[V]: Optional on some models

<b>A</b> 1.	Water intake pipe		23.	Front engine hanger	
<b>A</b> 2.	Air pump bracket "A"	[V]	<b>▲</b> 24.	Intake manifold	
<b>▲</b> 3.	Exhaust manifold		<b>▲</b> 25.	BP transducer and bracket	[V]
<b>4</b> .	Air pump bracket "B"	[V]	<b>▲</b> 26.	Carburetor	
<b>▲</b> 5.	Air pump	[V]	27.	Water outlet pipe	
<b>4</b> 6.	Air switching valve	[V]	<b>▲</b> 28.	Fuel pump	
<b>▲</b> 7.	Rubber hose (Air pump to A.S.V.)	[V]	<b>2</b> 9.	Fuel damper	
<b>&amp;</b> 8.	Alternator and bracket		<b>▲</b> 30.	EGR adapter	[V]
<b>4</b> 9.	Engine foot with mounting rubber		<b>▲</b> 31.	EGR valve	[V]
<b>1</b> 0.	Air manifold with check valve	[V]	<b>▲</b> 32.	Fast idle solenoid (with A/C)	[V]
<b>▲</b> 11.	Spark plug		<b>▲</b> 33.	Ignition coil	[V]
12.	Rubber hose (Air pump to air		<b>▲</b> 34.	Distributor	
	cleaner)	[V]	<b>▲</b> 35.	High tension cable (Ignition coil	
13.	Rubber hose (A.S.V. to air intake			to distributor)	[V]
	duct bracket)	[V]	<b>▲</b> 36.	EGR pipe	[V]
<b>▲</b> 14.	Rubber hose (A.S.V. to check		<b>▲</b> 37.	Engine foot with mounting rubber	
	valve)	[V]	<b>▲</b> 38.	Crankshaft pulley	
15.	Dipstick and guide tube		<b>▲</b> 39.	Cooling fan pulley	
16.	Oil pressure switch		<b>4</b> 0.	Cylinder head cover	
<b>▲</b> 17.	Starter motor		41.	High tension cable	
<b>▲</b> 18.	Oil filter adapter with oil filter		<b>▲</b> 42.	Cooling fan drive belt	
<b>1</b> 9.	Oil pressure unit	[V]	<b>▲</b> 43.	Compressor drive belt	[V]
20.	Compressor idler pulley and		<b>▲</b> 44.	Air pump drive belt	[V]
	bracket	[V]	<b>▲</b> 45.	Condenser	[V]
<b>▲</b> 21.	Compressor and bracket	[V]	<b>▲</b> 46.	Clutch pressure plate assembly	
<b>▲</b> 22.	Power steering oil pump and			and driven plate assembly	
	bracket	[V]			



#### Important Operations - Installation

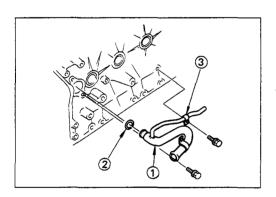
#### **Emission Control Vacuum Hoses**

Refer to the tags attached at disassembly to reinstall the emission control vacuum hose.

Follow the external parts installation step order.

If there are no tags attached, refer to the "VACUUM HOSE ROUTING DIAGRAM" in the section 6E.

It is very important that the hose be installed correctly.



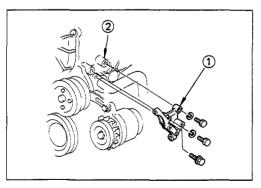


#### 1. Water Intake Pipe

- 1) Install the intake pipe ① together with the O-ring ② and the clip ③ to the cylinder body.
- 2) Tighten the intake pipe bolts to the specified torque.

Intake Pipe Bolt Torque kg·m(lb.ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 



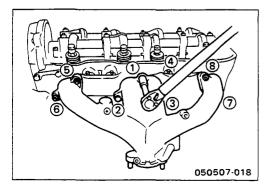


#### 2. Air Pump Bracket "A" [V]

- 1) Install the air pump bracket "A" ① to the cylinder body ②.
- Tighten the bracket bolts to the specified torque.

Air Pump Bracket "A" Bolt Torque kg-m(lb.ft/N-m)

 $5.6 \pm 0.8 \ (40.5 \pm 5.8/54.9 \pm 7.8)$ 





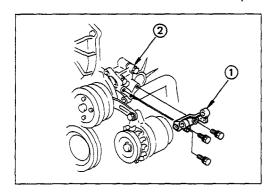
#### 3. Exhaust Manifold

1) Install the manifold gasket with the stamped mark facing outward.



2) Tighten the exhaust manifold bolts to the specified torque a little at a time in the numerical order shown in the illustration.

Exhaust Manifold Bolt Torque kg·m(lb.ft/N·m)  $2.2 \pm 0.3 (15.9 \pm 2.2/21.6 \pm 2.9)$ 

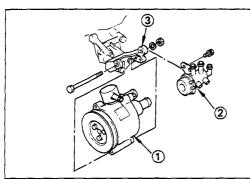




#### 4. Air Pump Bracket "B" [V]

- 1) Install the air pump bracket "B" ① to the air pump bracket "A" ②.
- 2) Tighten the bracket bolts to the specified torque.

Air Pump Bracket "B" Bolt Torque kg·m(lb.ft/N·m)  $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 





#### 5. Air Pump [V]

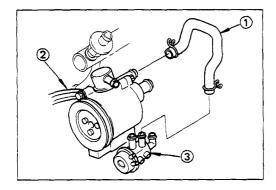
#### 6. Air Switching Valve [V]

- 1) Install the air pump ① and the air switching valve ② to the pump bracket "B" ③.
- 2) Tighten the air pump nuts to the specified torque.

Air Pump Nut Torque kg·m(lb.ft/N-m)  $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

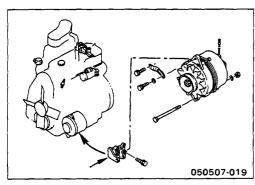
 Tighten the air switching valve bolts to the specified torque.

Air Switching Valve Torque kg-m(lb.ft/N-m)  $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 





Connect the rubber hose ① between the air pum and the air switching valve ③.



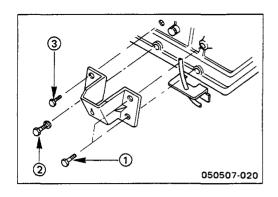


#### 8. Alternator and Bracket

 Install the alternator bracket to the cylinder body and tighten the bracket bolts to the specified torque.

Transmission Nut and Bolt Torque kg·m(lb.ft/N·m)  $3.8 \pm 1.0 (27.5 \pm 7.2/37.3 \pm 9.8)$ 

- Install the alternator to the bracket.
   Tighten the through bolt.
- 3) Temporarily tighten the adjusting bolt.

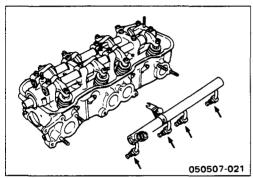




#### 9. Engine Foot with Mounting Rubber

Tighten the engine left side foot bolts to the specified torque.

Engine Foot Bolt Torque		kg·m(lb.ft/N·m)
1	8.4 ± 0.8 (60.8 ±	5.8/82.4 ± 7.8)
2	12.9 ± 1.5 (93.3 ±	10.8/126.5 ± 14.7)
3	4.1 ± 0.6 (29.7 ±	4.3/40.2 ± 5.9)
-		



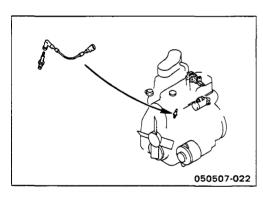


#### 10. Air Manifold with Check Valve [V]

1) Hand-tighten the four sleeve bolts.

Use a wrench to tighten the sleeve nuts to the specified torque.

Air Manifold Sleeve Nut Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6	± 4.9)

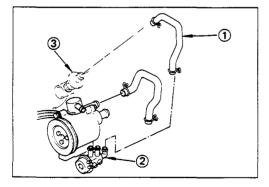


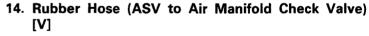


#### 11. Spark Plug

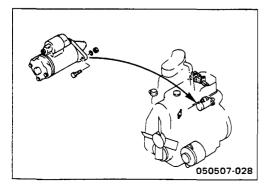
Tighten the spark plugs to the specified torque.

Spark Plug Torque	kg ·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ±	3.6/18.6 ± 4.9)





Connect the rubber hose ① between the air switching valve ② and the air manifold check valve ③.

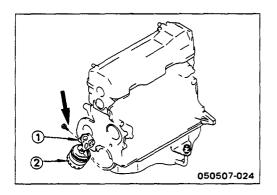




#### 17. Starter Motor

- Install the starter motor to the rear plate.
- Tighten the starter motor bolts to the specified torque.

Starter Motor Torque	kg-m(lb.ft/N-m)
$8.8 \pm 1.9$ (63.7 $\pm$	13.7/86.2 ± 18.6)

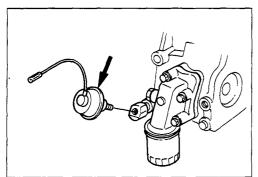




#### 18. Oil Filter Adapter with Oil Filter

- 1) Install the oil filter adapter ① and the oil filter ② to the cylinder body.
- 2) Tighten the oil filter adapter bolts to the specified torque.

Oil Filter Adapter Bolt Torque	kg·m(lb.ft/N·m)
$1.9 \pm 0.5$ (13.7 $\pm$	3.6/18.6 ± 4.9)

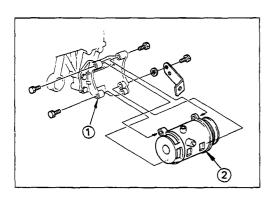




#### 19. Oil Pressure Unit [V]

- 1) Install the oil pressure unit to the oil filter adapter.
- 2) Tighten the unit to the specified torque.

Oil Pressure Unit Torque	kg·m(lb.ft/N·m)
0.75 ± 0.15 (4.3 ±	1.1/5.9 ± 1.5)





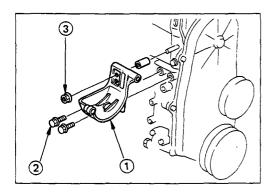
#### 21. Compressor and Bracket [V]

- Install the compressor bracket ① to the cylinder body.
- 2) Tighten the compressor bracket bolts to the specified torque.

Compressor	Bracket Bolt Torque	kg·m(lb.ft/N·m)
	$4.1 \pm 0.6$ (29.7 $\pm$ 4.3/40.2 $\pm$	5.9)

- 3) Install the compressor ② to the compressor bracket.
- 4) Hand-tighten the compressor bolts.
- 5) Tighten the compressor bolts at the front side of the compressor to the specified torque.
- 6) Tighten the compressor bolts at the rear side of the compressor to the specified torque.

Compressor Bolt Torque	kg·m(lb.ft/N·m)
$4.1 \pm 0.6 \ (29.7 \pm 4.3/40)$	0.2 ± 5.9)





#### 22. Power Steering Oil Pump and Bracket [V]

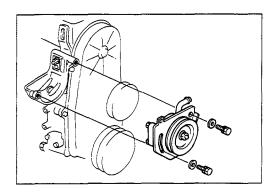
- 1) Install the power steering oil pump bracket ① to the cylinder body.
- 2) Tighten the oil pump bracket nuts ② and bolts ③ to the specified torque.

Power Steering Oil Pump Bracket Torque kg·m(lb.ft/N·m)

Nut

2.7 + 0.5 (19.5 + 3.6/26.5 + 4.9)

Nut	$2.7 \pm 0.5 \ (19.5 \pm 3.6/26.5 \pm 4.9)$
Bolt	$4.1 \pm 0.6 (29.7 \pm 4.3/40.2 \pm 5.9)$



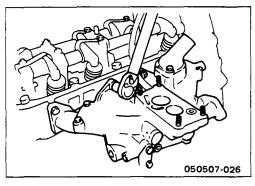


- 3) Install the power steering oil pump to the oil pump bracket.
- 4) Temporarily tighten the oil pump bolts.

The oil pump bolts will be tightened to the specified torque after the drive belt tension is adjusted.

Power Steering Oil Pump Bolt Torque kg·m(lb.ft/N·m)

 $3.8 \pm 1.0 (27.5 \pm 7.2/37.2 \pm 9.8)$ 





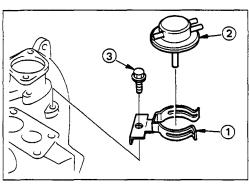
#### 24. Intake Manifold

Install the intake manifold and tighten the bolts to the specified torque.

Intake Manifold Bolt Torque

kg·m(lb.ft/N·m)

 $2.2 \pm 0.3 \ (15.9 \pm 2.2/21.6 \pm 2.9)$ 





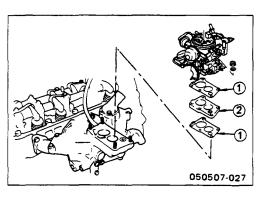
#### 25. B.P. Transducer and Bracket [V]

- 1) Install the back pressure transducer bracket ① and the back pressure transducer ② to the intake manifold.
- 2) Tighten the bracket bolts 3 to the specified torque.

B.P. Transducer Bracket Bolt Torque

kg-m(lb.ft/N·m)

 $1.3 \pm 0.5 \ (9.4 \pm 3.6/12.7 \pm 4.9)$ 





#### 26. Carburetor

 Install the gaskets ① and the heat insulator ② (if so equipped) to the intake manifold.



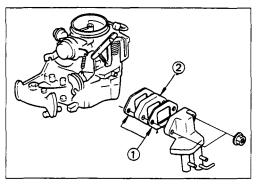
- 2) Install the carburetor to the intake manifold.
- 3) Use the carburetor wrench to tighten the carburetor nuts to the specified torque.

Carburetor Wrench: 5-8511-9003-0 (J-26510)

Carburetor Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.3 \pm 0.5 \ (9.4 \pm 3.6/12.7 \pm 4.9)$ 





#### 28. Fuel Pump

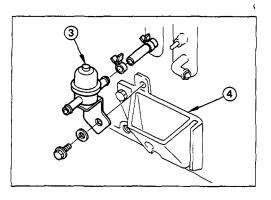
#### 29. Fuel Damper

- ) Install the fuel pump together with the gaskets ① and the heat insulator ② to the cylinder body.
- 2) Tighten the fuel pump nuts to the specified torque.

Fuel Pump Nut Torque

kg·m(lb.ft/N·m)

 $2.7 \pm 0.5 (19.5 \pm 3.6/26.5 \pm 4.9)$ 



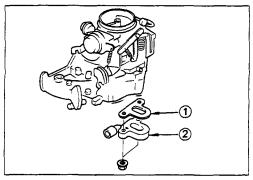


- 3) Install the fuel damper ③ to the cylinder body ④.
- 4) Tighten the damper bolts to the specified torque.

Fuel Damper Bolt Torque kg·m(lb.ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

5) Connect the fuel hose between the fuel pump and the damper.





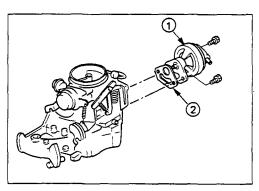
#### 30. EGR Adapter [V]

- Install the EGR adapter ① together with the gasket
   2 to the intake manifold.
- 2) Tighten the adapter nuts to the specified torque.

EGR Adapter Nut Torque

kg·m(lb.ft/N·m)

 $2.7 \pm 0.5 (19.5 \pm 3.6/26.5 \pm 4.9)$ 





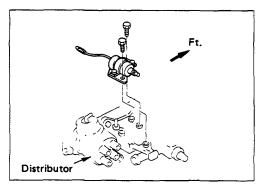
#### 31. EGR Valve [V]

- 1) Install the EGR valve ① together with the gasket ② to the intake manifold.
- 2) Tighten the EGR valve bolts to the specified torque.

EGR Valve Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 





#### 32. Fast Idle Solenoid (For with A/C) [V]

- 1) Install the fast idle solenoid to the cylinder head.
- 2) Tighten the solenoid bracket bolts to the specified torque.

Solenoid Bracket Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.3 \pm 0.5 \ (9.4 \pm 3.6/12.7 \pm 4.9)$ 



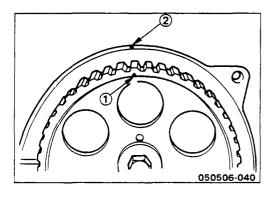
#### 33. Ignition Coil [V]

- 1) Install the ignition coil to the intake manifold.
- 2) Tighten the ignition coil bolts to the specified torque.

Ignition Coil Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $0.75 \pm 0.25 (5.4 \pm 1.8/7.4 \pm 2.5)$ 





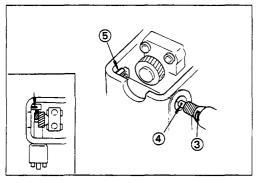
#### 34. Distributor

1) Move the No. 4 cylinder to TDC on the compression stroke.



Align the camshaft pulley setting mark ① with the front plate setting mark ②.

2) Apply engine oil to the O-rings.





3) Align the distributor case setting mark ③ with the distributor shaft setting mark ④.



- Install the distributor to the cylinder head.
   Align the distributor shaft setting mark with the cylinder head setting mark ⑤.
- 5) Tighten the distributor bolts to the specified torque.

Distributor Bolt Torque kg-m(lb.ft/N-m)  $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

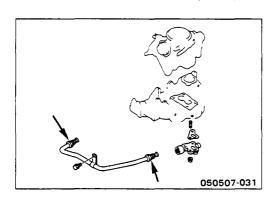


## 35. High Tension Cable (Ignition Coil to Distributor) [V]

- 1) Connect the high tension cable red end ① to the distributor.
- 2) Connect the high tension cable black end ② to the ignition coil.

#### Note:

Take care not to reverse cable polarity.

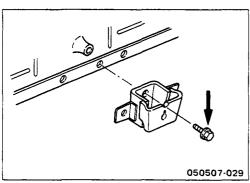




#### 36. EGR Pipe [V]

- Connect the EGR pipe between the EGR adapter and the exhaust manifold.
- 2) Tighten the pipe nuts to the specified torque.

EGR Pipe Nut Torque kg·m(lb.ft/N·m)  $4.5 \pm 0.5 (32.5 \pm 3.6/44.1 \pm 4.9)$ 

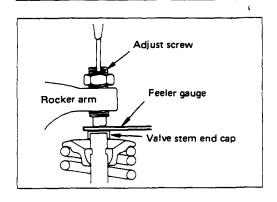




#### 37. Engine Foot with Mounting Rubber

Tighten the engine right side foot bolts to the specified torque.

Engine Foot Bolt Torque kg·m(lb.ft/N-m)  $8.4 \pm 0.8 (60.8 \pm 5.8/82.4 \pm 7.8)$ 

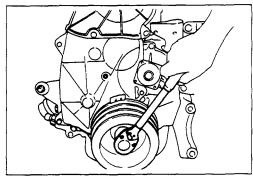




Note on Valve Clearance Adjustment

Valve clearances must be adjusted before the cylinder head cover is reinstalled.

Refer to "VALVE CLEARANCE ADJUSTMENT" in the "SERVICING" Section of this Manual.



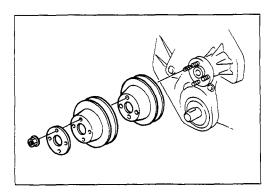
#### 38. Crankshaft Pulley

Install the crankshaft pulley and tighten the pulley bolt to the specified torque.

Crankshaft Pulley Bolt Torque

kg·m(lb.ft/N·m)

 $12.0 \pm 1.5 (86.8 \pm 10.8/117.6 \pm 14.7)$ 



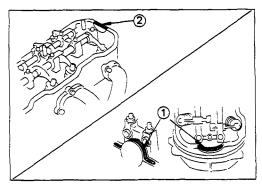
#### 39. Cooling Fan Pulley

- 1) Install the cooling fan pulley to the water pump.
- 2) Tighten the pulley nut to the specified torque.

Cooling Fan Pulley Nut Torque

kg⋅m(lb.ft-

 $2.7 \pm 0.5 (19.5 \pm 3.6/26.5 \pm 4.9)$ 



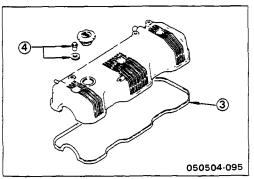


#### 40. Cylinder Head Cover

1) Apply the recommended liquid gasket or its equivalent to the cylinder head No. 1 camshaft bracket arch ① and the rear side of the cylinder plug ②.

Refer to the illustration.

2) Apply engine oil to the rocker arms and the valve springs.





 Install the cylinder head cover gasket ® to the cylinder head cover.

Be absolutely sure that the gasket is correctly positioned.

There must be no loose areas.

4) Tighten the cylinder head cap nuts ④ to the specified torque.

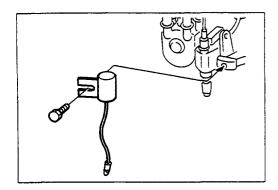
Cylinder Head Cap Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.0 \pm 0.2 (7.2 \pm 1.4/9.8 \pm 1.98)$ 

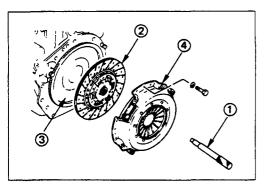


- 42. Cooling Fan Drive Belt
- 43. Compressor Drive Belt
- 44. Air Pump Drive Belt [V]
- 1) Install each of the drive belts.
- Adjust the tension of each of the drive belts.
   Refer to "SERVICING DRIVE BELT ADJUSTMENT" in this Manual.



#### 45. Condenser [V]

The condenser must be positioned horizontally.



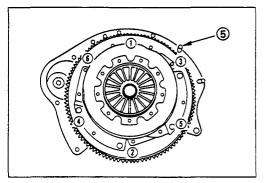


# 46. Clutch Pressure Plate Assembly and Driven Plate Assembly



- 1) Clean the flywheel surface.
- 2) Clean the driven plate facing surface.
- 3) Use the clutch pilot aligner ① to install the driven plate assembly ② to the flywheel ③.

Clutch Pilot Aligner: 5-8525-3001-0 (J-24547)





4) Clean the pressure plate surfaces.



- 5) Align the pressure plate assembly ④ with the flywheel knock pin ⑤.
- 6) Install the pressure plate assembly to the flywheel.
- 7) Tighten the clutch cover bolts to the specified torque a little at a time in the numerical order shown in the illustration.

Clutch Cover Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

#### **LUBRICATING SYSTEM**

06010102

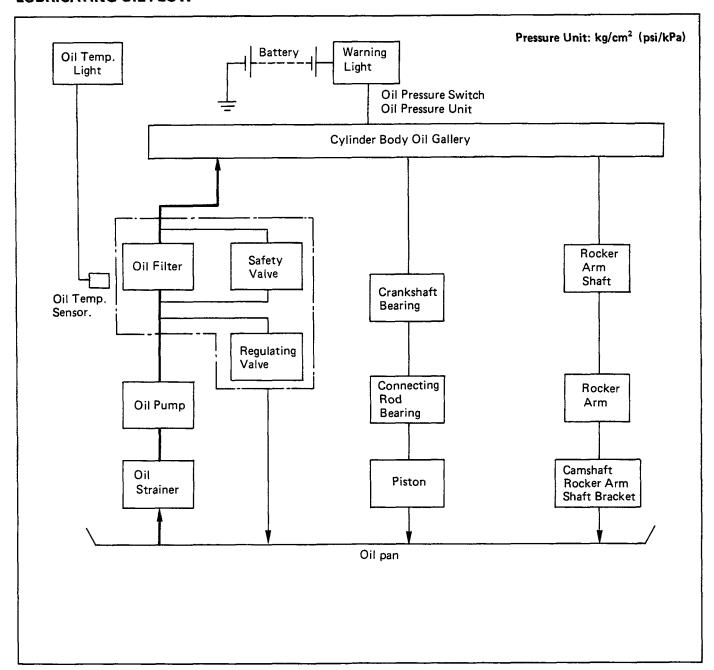
#### MAIN DATA AND SPECIFICATIONS

Item	Description	
Oil pump type	Trochoid	
Oil pressure switch operating pressure kg/cm²(psi/kPa)	0.2 - 0.5 (2.8 - 7.1/19.6 - 49.0)	
Oil filter type	Full flow with cartridge paper element	
Regulating valve opening pressure kg/cm²(psi/kPa)	4 — 5 (56.9 — 71.1/392.4 — 490.5)	
Safety valve opening pressure kg/cm²(psi/kPa)	0.8 — 1.2 (11.4 — 17.1/78.4 — 117.6)	

#### **GENERAL DESCRIPTION**

06020102

#### LUBRICATING OIL FLOW



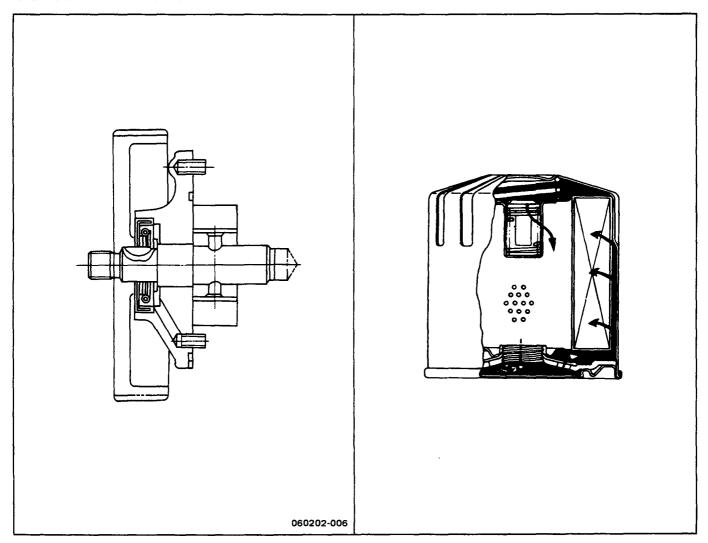
The 4Z Series engine lubricating system is a full flow pressurized circulation type.

Lubricating oil is pumped from the oil pump to the cylinder body oil gallery through the oil filter. It is then delivered to the vital parts of the engine from the cylinder body oil gallery.

#### Only Saudi Arabia;

The OIL TEMP. indicator light on the instrument panel illuminates when the engine oil temperature becomes high (approx. 135°C).

#### **OIL PUMP AND OIL FILTER**



The trochoid oil pump is built in to the front of the cylinder body. It is driven by the timing pulley and the timing belt.

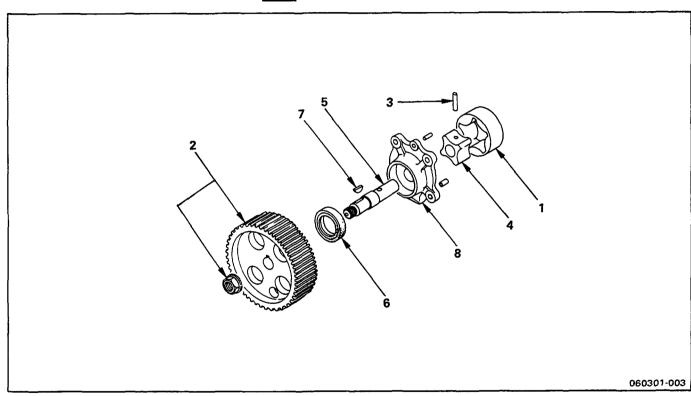
The oil filter with easily replaceable cartridge paper element is at the lower right front side of the engine.

**OIL PUMP** 

06030102A



DISASSEMBLY



06030102B

### Disassembly Steps

- Oil pump outer rotor
   Oil pump drive pulley
- 3. Inner rotor pin
- 4. Oil pump inner rotor

- 5. Oil pump shaft
- 6. Oil seal
- 7. Oil pump shaft key8. Oil pump body

mm/in)

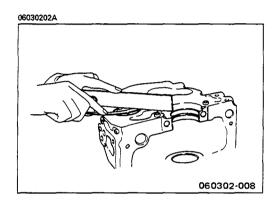
mm(in)

060302



#### **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





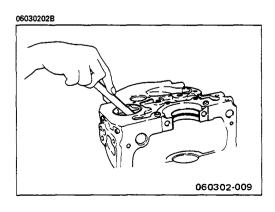
#### **Outer Rotor and Cylinder Body Clearance**

- 1. Install the outer rotor to the cylinder body.
- 2. Use a feeler gauge and straight edge to measure the clearance between the outer rotor surface and the cylinder body.

If the clearance between the outer rotor surfact the cylinder body exceeds the specified limit, t pump gear set (outer rotor, rotor pin, inner row), and oil pump shaft) must be replaced.

Outer Rotor Surface and Cylinder Body

Limit	
0.15 (0.0059)	





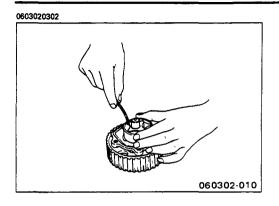
 Use a feeler gauge to measure the clearanctween the outer rotor sliding face and the cybody.

If the clearance between the outer rotor sliding tale and the cylinder body exceeds the specified limit, the oil pump gear set (outer rotor, rotor pin, inner rotor, and oil pump shaft) and/or the cylinder body must be replaced.

Outer Rotor Sliding Face and Cylinder Body Clearance

Standard	Limit	
0.24 — 0.36 (0.009 — 0.014)	0.40 (0.016)	

#### **6A-126 ENGINE MECHANICAL**





#### **Outer and Inner Rotor Clearance**

Use a feeler gauge to measure the clearance between the outer and inner rotor.

If the clearance between the outer and inner rotor exceeds the specified limit, the oil pump gear set (outer rotor, rotor pin, inner rotor, and oil pump shaft) must be replaced.

Outer and Inner Rotor Clearar	nce mm(in)
Standard	Limit
0.13 — 0.15 (0.005 — 0.006)	0.20 (0.008)



#### **New Inner Rotor Installation**

- 1. Install the new inner rotor to the oil pump shaft.
- 2. Insert the rotor pin into the pin hole.
- Caulk both sides of the rotor pin.

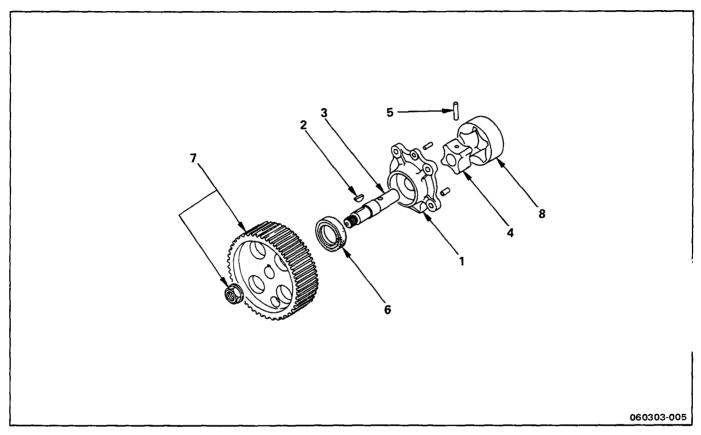
#### Note:

Do not allow the rotor pin caulking to project from the rotor.

060303A



#### **REASSEMBLY**



0603030002

#### **Reassembly Steps**

- 1. Oil pump body
- 2. Oil pump shaft key
- 3. Oil pump shaft
- 4. Oil pump inner rotor

- 5. Inner rotor pin
- ▲ 6. Oil seal
- ▲ 7. Oil pump drive pulley
  - 8. Oil pump outer rotor



#### **Important Operations**

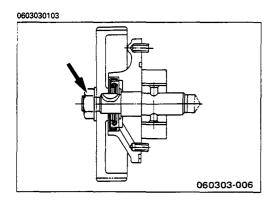
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#### 6. Oil Seal

1) Apply engine oil to the oil seal lip circumference and the oil seal outer circumference and install it using installer.

Installer: J-26587

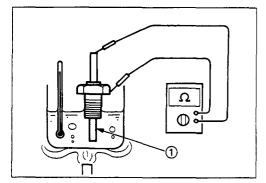




#### 7. Oil Pump Drive Pulley

Tighten the oil pump drive pulley bolt to the specified torque.

Drive Pulley Nut Torque		kg·m(lb.ft/N·m		
	7.7	+ 1.0 (55.7	+ 7.2/75.5	+ 9.8)





#### Oil Temperature Sensor (Only Saudi Arabia)

- 1. Submerge the oil temperature sensor sensing portion ① in water.
- Connect a circuit tester to the oil temperature sensor.
- 3. Use a burner to heat the water.
- 4. Check the oil temperature sensor resistance at the specified temperature.

Oil Temperature Sensor Resistance		Ω
at 25°C (77°F)	Approximately 10	
at 100°C (212°F)	Approximately 1	

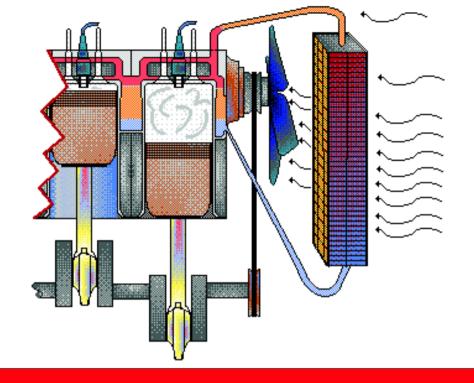


Specs.

Water Pump

**Thermostat** 

Fan



# KB TF 140 Cooling System

# SECTION 6B ENGINE COOLING

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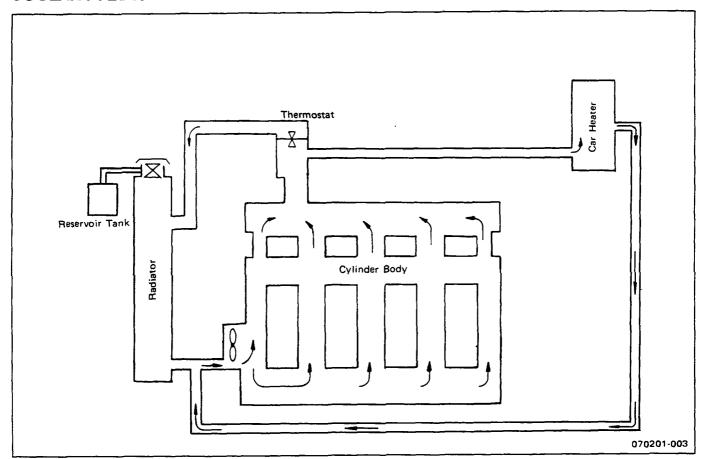
#### MAIN DATA AND SPECIFICATIONS

Item		Description	
		4ZC1	4ZE1
Water pump type		Centrifugal impeller	
Pump to crankshaft speed ratio (	to 1)	1.22	1.23
Delivery volume	lit(US/UK gal)/min	155 (41.0/34.8)	190 (50.2/41.8
Pump speed at 6000 rpm			ı
Pump bearing type		Double	row shaft
Thermostat type		Wax pellet w	th jiggle valve
· Valve initial opening temperature	°C(°F)	82 (180)	
Valve full opening temperature	°C(°F)	95 (203)	
Valve lift at fully open position mm(in)		8 (0	0.31)

#### **GENERAL DESCRIPTION**

07020102

#### **COOLANT FLOW**



The engine cooling system consists of the radiator, the water pump, the cooling fan, and the thermostat.

To quickly increase cold engine coolant temperature for smooth engine operation, the coolant is circulated by the water pump and thermostat through the bypass hose and back to the cylinder body. The coolant does not circulate through the radiator.

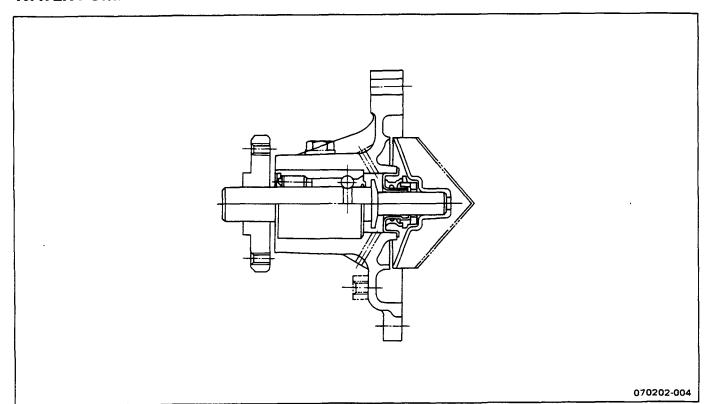
When the coolant temperature reaches the specified level 82°C (180°F), the thermostat will begin to open and a gradually increasing amount of coolant will circulate through the radiator.

The thermostat will be fully open when the coolant temperature reaches the specified upper level 95°C (203°F). All of the coolant is now circulating through the radiator for effective engine cooling.

#### 6B-4 ENGINE COOLING

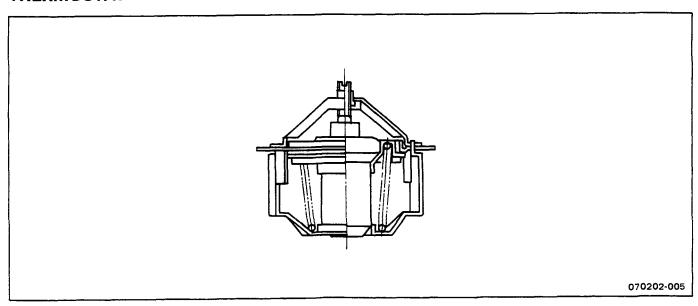
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#### **WATER PUMP**



#### 070202B

#### **THERMOSTAT**



A centrifugal type water pump force fully circulates the coolant through the cooling system.

A wax pellet type thermostat is used.

The jiggle valve accelerates engine warm-up.

#### **WATER PUMP**





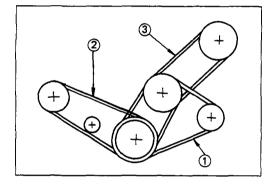
#### **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

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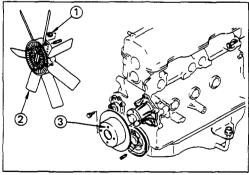
#### Important Operations — Removal

V : Optional on some models



#### **Drive Belt**

Remove the cooling fan belt ①, the compressor belt ②  $\boxed{V}$ , and the air pump drive belt ③  $\boxed{V}$ .

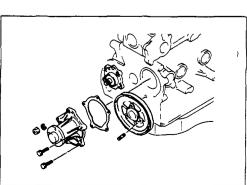


#### **Cooling Fan and Cooling Fan Pulley**

- 1. Loosen the cooling fan, and the fan pulley nuts ①.
- 2. Remove the cooling fan ② together with the fan pulley ③.

#### **Water Pump**

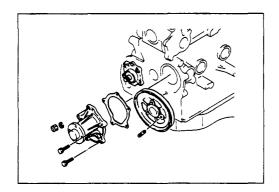
- 1. Remove the water pump nuts and bolts.
- 2. Remove the water pump.





#### Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





#### Water pump

- 1. Install the water pump to the cylinder body.
- 2. Tighten the water pump nuts and bolts to the specified torque.

Mater Pump Bolt Torque	kg·m(lb.ft/N·m)
2.7 ± 0.5 (19.5 ± 3.6	/26.5 ± 4.9)
Water Pump Nut Torque	kg·m(lb.ft/N·m)



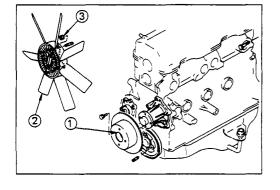
#### Cooling Fan Pulley and Cooling Fan

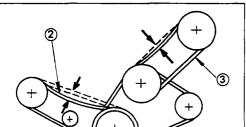
Install the fan pulley ① together with the cooling fan
 ②.

 $1.5 \pm 0.5 \ (13.7 \pm 3.6/18.6 \pm 4.9)$ 

2. Tighten the fun pulley nuts ③ to the specified torque.

$2.7 \pm 0.5 \ (19.5 \pm 3.6/26.5 \pm 0.5)$	Fan Pulley Nut Torque		kg·m(lb.ft/N·m)
		$2.7 \pm 0.5$ (19.5 $\pm$ 3.6)	/26.5 ± 0.5)







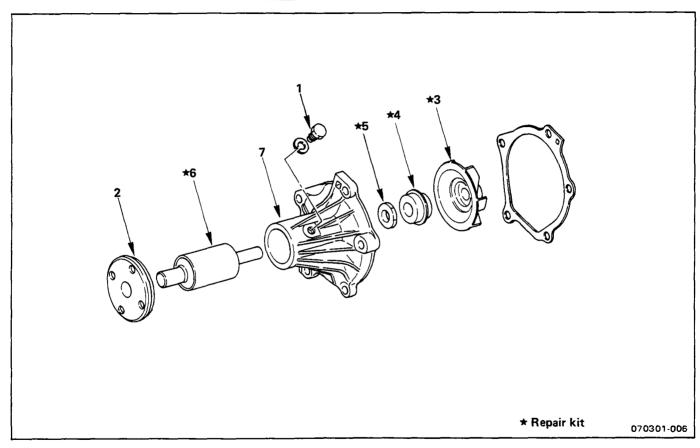
#### **Drive Belt**

- I. Install the cooling fan belt ①, the compressor belt ②  $\overline{V}$  , and the air pump belt ③  $\overline{V}$  .
- 2. Apply tension to each drive belt by moving the alternator, the compressor idler pulley (4), and the air pump.
- 3. Apply a force of 10 kg (22 lb/98 N) to the drive belt mid-portion to check the drive belt deflection.

Cooling Fan Drive Belt Deflection mm(in)
10 (0.39)

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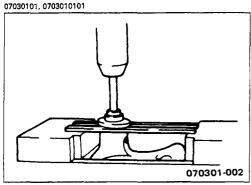
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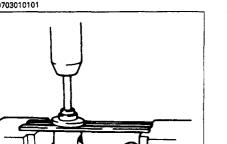
#### **Disassembly Steps**

- 1. Set screw
- 2. Cooling fan center
- ▲ 3. Impeller
- ▲ 4. Seal unit

- 5. Thrower
- 6. Bearing unit
  - 7. Water pump body

#### **6B-8 ENGINE COOLING**



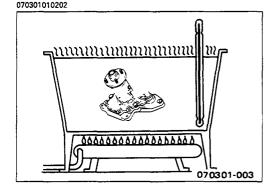


#### **Important Operations**

#### 2. Cooling Fan Center

Remove the fan center with a bench press and a bar.

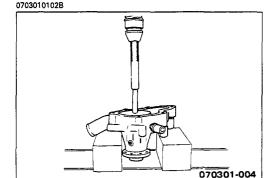
- 3. Impeller
- 4. Seal Unit
- 6. Bearing Unit
- Heat the pump body in hot water (80 90°C/176 -194°F).



unit with a bench press and a bar. Note:

Do not drive out the impeller with a hammer. Damage to the impeller will result.

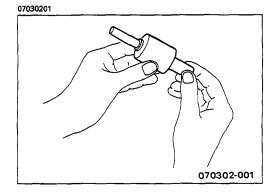
Remove the impeller, the seal unit, and the bearing





#### INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

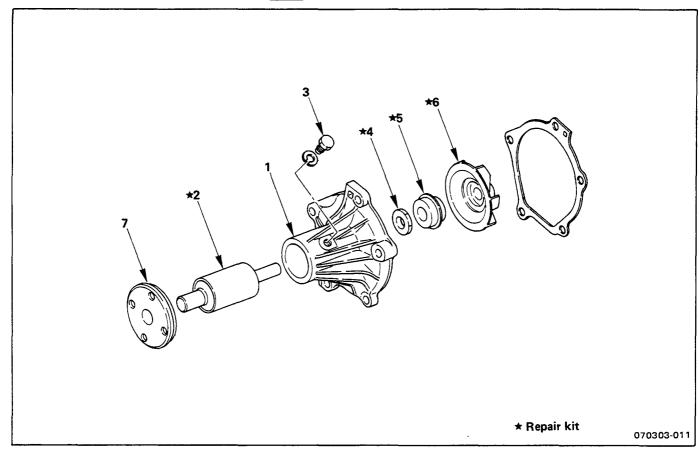


#### **Bearing Unit**

Check the bearing for abnormal noise, binding, and other abnormal conditions.

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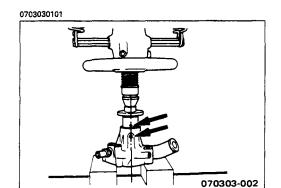
#### Reassembly Steps

- 1. Water pump body
- ▲ 2. Bearing unit
- ▲ 3. Set screw 4. Thrower

- ▲ 5. Seal unit
- ▲ 6. Impeller
- ▲ 7. Cooling fan center



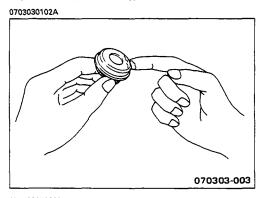
#### **Important Operations**





#### 2. Bearing Unit

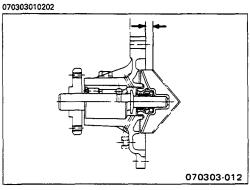
- 3. Set Screw
- 1) Align the bearing set screw hole with the pump body set screw hole.
- 2) Press the bearing unit into place.
- Secure the bearing with the set screw.





#### 5. Seal Unit

- 6. Impelier
- 1) Apply the recommended liquid gasket or its equivalent to the seal unit outer periphery.
- 2) Install the seal unit.



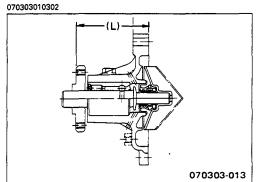


Use a bench press to slowly force the impeller into place until the impeller installed distance from the water pump body face is equal to the specified value.

#### Impeller Projection (Reference)

mm(in)

Standard		
4ZC1	8.5 – 8.9 (0.33 – 3.66)	
4ZE1	5.5 - 5.9 (0.21 - 0.23)	





#### 7. Cooling Fan Center

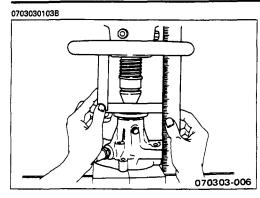
Measure the distance between the cooling fan fitting face and the rear cover fitting face.

Cooling	Fan	Center	Distance	(L)
---------	-----	--------	----------	-----

mm(in)

Standard			
4ZC1	92.3 – 92.9 (3.63 – 3.66)		
4ZE1	99.2 – 99.8 (3.90 – 3.93)		

#### **6B-12 ENGINE COOLING**



#### Notes:

- 1. The fan center and the impeller are installed to the water pump shaft with a press.
  - Never attempt to remove and reinstall the fan center and the impeller a second time. Replace the entire water pump assembly.
  - Removing and reinstalling the fan center and the impeller a second time may result in the breakdown of the water pump during engine operation and subsequent serious overheating problems.
- The water pump assembly must be replaced whenever the fan center and impeller pressure force falls below 200 kg (441 lb/1,960 N).
- 3. Do not attempt to strike the bearing into position with a hammer or similar object. Damage to the bearing will result.

#### **THERMOSTAT**



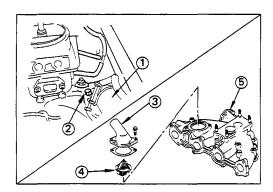


#### **REMOVAL AND INSTALLATION**

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#### Important Operations — Removal



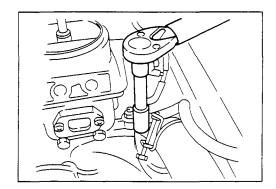
#### **Thermostat**

- 1. Partially drain the engine coolant.
- 2. Disconnect the radiator upper hose ① from the water outlet side ②.
- 3. Remove the outlet pipe ③, and the thermostat ④ from the intake manifold ⑤.



#### Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





#### **Water Outlet Pipe**

- . Install the outlet pipe with thermostat to the intake manifold.
- 2. Tighten the outlet pipe bolts to the specified torque.

Outlet Pipe Bolt Torque

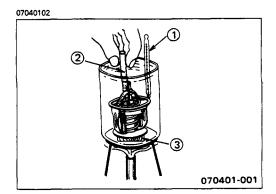
kg·m(lb.ft/N·m)

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 



## **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





## **Operating Test**

- 1. Completely submerge the thermostat in water.
- 2. Heat the water.

Stir the water constantly to avoid direct heat being applied to the thermostat.

3. Check the thermostat initial opening temperature.

Thermostat Initial Opening Temperature	°C(°F)
82 (180)	

1. Check the thermostat full opening temperature.

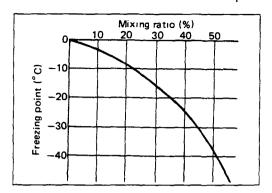
Thermostat Full Opening Temperature	°C(°F)
95 (203)	

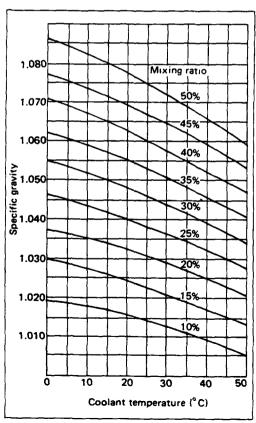
Valve Lift as	Full Open	Position	

mm(in)

8 (0.31)

- ① Thermometer
- ② Agitating rod
- ③ Wooden piece





### **ANTI-FREEZE SOLUTION**

### 1. Relation between Mixing Ratio and Freezing Point

Freezing temperature of the engine coolant varies with the ratio of anti-freeze solution in water.

Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.

### 2. Calculation on Mixing Ratio

Mixing Ratio - Anti-freeze solution (lit/gal.)

Anti-freeze solution (lit/gal.) + Water (lit/gal.)

### Note:

Anti-freeze solution + Water = 8.6 lit. (2.2 US gal./ 1.9 UK gal.) for 4ZC1 or 9.0 lit. (2.3 US gal./2.0 UK gal.) for 4ZD1/4ZE1.

### 3. Mixing Ratio

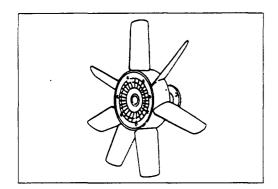
Check the specific gravity of engine coolant in the cooling system at temperature ranges from 0°C (32°F) to 50°C (122°F) using a suction type hydrometer, then determine the density of the coolant by referring to the table at the left.

## **FAN CLUTCH WITH COOLING FAN**



## **INSPECTION AND REPAIR**

Make necessary correction or parts replacement if wear, damage or any other abnormal condition are found through inspection.



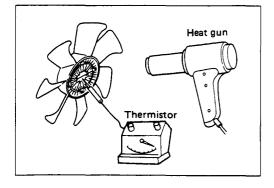


Visually inspect for damage, leak (silicon grease) or other abnormal conditions.

### 1. Inspection (on-vehicle)

- Turn the fan clutch by hand when in a low temperature condition before starting the engine, and confirm that it can be turned readily.
- 2) Start the engine to warm it up until the temperature at the fan clutch portion gets to around 80°C. Then stop the engine and confirm that the fan clutch can be turned with considerable effort (clutch torque) when turned by hand.

If the fan clutch rotates more readily, however, this indicates that the silicon grease is leaking internally. Replace the fan clutch with a new one.



## 2. Inspection (in unit)

Warm up the bimetal of the fan clutch by using the heat gun until the temperature gets to about 80°C when measured with the thermistor. Then confirm that the fan clutch can be turned with considerable effort (clutch torque).

If the fan clutch retates more readily at this time, this indicates that the silicon grease is leaking internally. Replace the fan clutch with a new one.

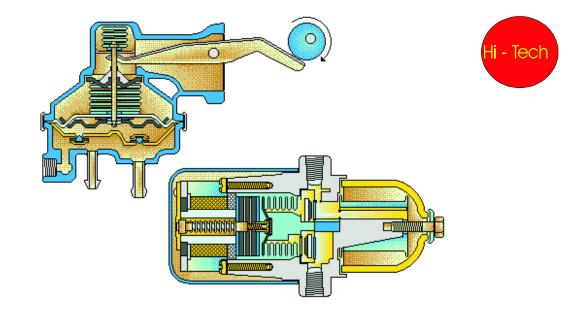


Index

Pump

Carb

Tank



# KB TF 140 Fuel System - Petrol

# SECTION 6C FUEL SYSTEM

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## MAIN DATA AND SPECIFICATIONS

Item	1	Description 4ZD1
Carburettor model		21E304-M82
Manufacturer		Nippon Kikai
Туре		Stromberg 2-barrel 2-stage
Fuel pressure	kg/cm²(psi/kPa)	0.24 (3.4/23.5)
Jet orifice diameters		
Main jet	(P) mm(in)	1.16 (0,046)
	(S) mm(in)	1.70 (0,067)
Main air bleed	(P) mm(in)	0.60 (0.024)
	(S) mm (in)	0.60 (0.024)
Slow jet	(P) mm(in)	0.52 (0.020)
	(S) mm(in)	0.80 (0.031)
Slow air bleed	(P1) mm(in)	0.80 (0.031)
	(S) mm(in)	1.20 (0.047)
	(P2) mm(in)	1.65 (0.065)
Slow economizer	mm(in)	1.60 (0.063)
Power jet	mm(in)	0.55 (0.022)
Air jet	mm(in)	2.40 (0.094)
Fuel pump		Mechanical diaphragm
Fuel filter		Paper (Cartridge type)

## **NOTES:**

- (P) = Primary
- (S) = Secondary

## MAIN DATA AND SPECIFICATIONS

lten	1	Description 4ZE1
Carburettor model		DCR384-205, DCR384-206
Manufacturer		Hitachi
Type		Stromberg 2-barrel 2-stage
Fuel pressure	kg/cm²(psi/kPa)	0.25 (3.6/24.5)
Jet orifice diameters		
Main jet	(P)	#133
•	(S)	#180
Main air bleed	(P)	#85
	(S)	#60
Slow jet	(P)	#50
-	(S)	#100
Slow air bleed	(P1)	#160
Slow economizer		#1.80
Power jet		#50
Fuel pump		Mechanical diaphragm
Fuel filter		Paper (Cartridge type)
<u> </u>		

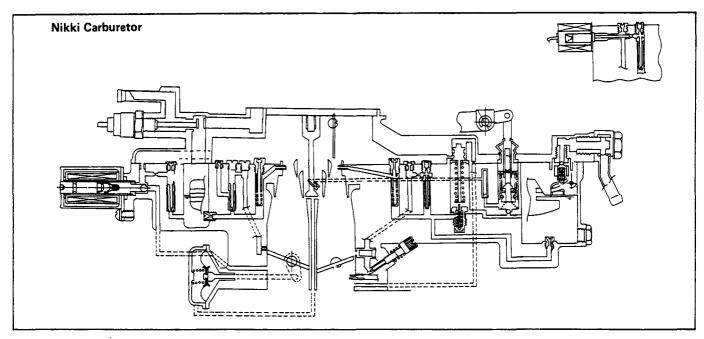
## NOTES:

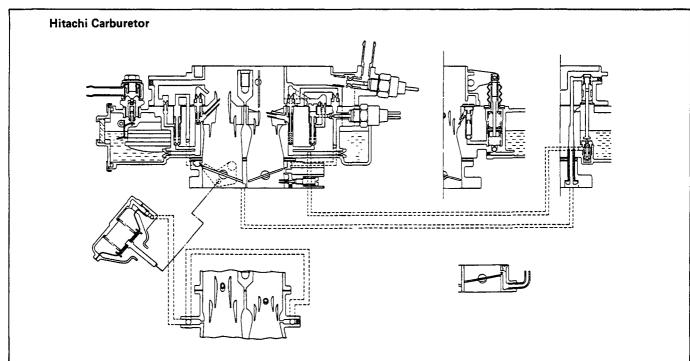
- (P) = Primary
- (S) = Secondary

## **GENERAL DESCRIPTION**

080206

## **CARBURETOR**



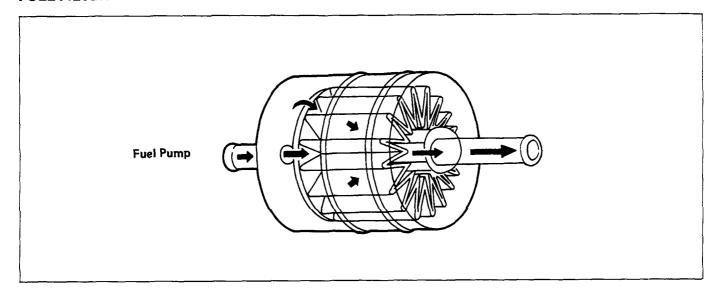


The 4Z Series engine uses a Stromberg 2-barrel, 2-stage carburetor. There are seven circuits.

- 1. Float chamber circuit
- 2. Slow speed circuit
- 3. Main circuit
- 4. Acceleration circuit
- 5. Step circuit
- 6. Power enrichment circuit
- 7. Choke circuit

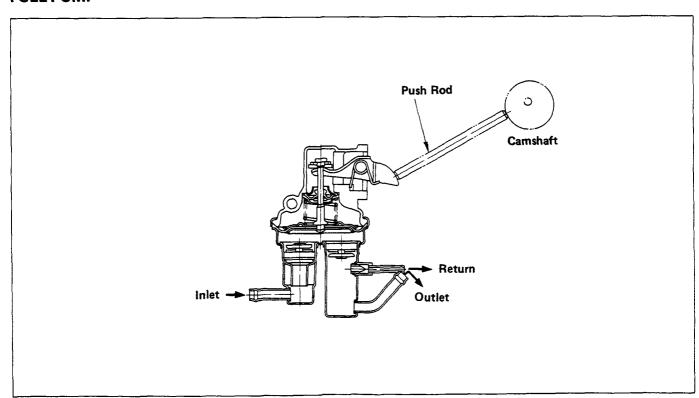
The circuits operate either independently or in tandem. The best air-fuel mixture is delivered to the cylinders over a wide range of operating conditions.

## **FUEL FILTER**



The fuel filter uses a large scale disposable cartridge type element.

## **FUEL PUMP**



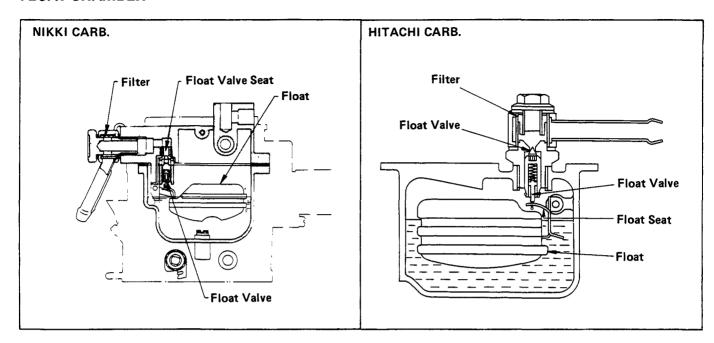
The 4Z Series engine use a mechanical fuel pump.

A push rod from the camshaft eccentric moves the pump lever to operate the pump.

## **CARBURETOR CONSTRUCTION**

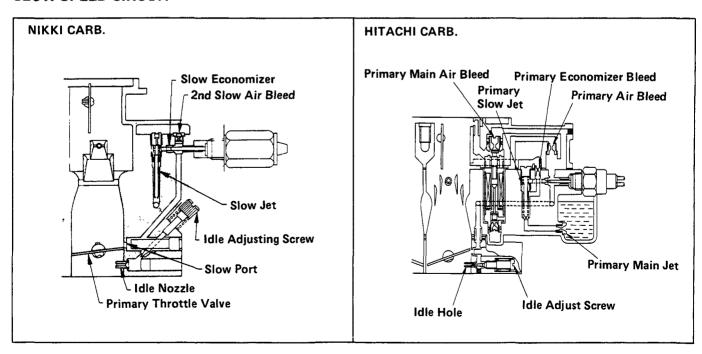
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### **FLOAT CHAMBER**



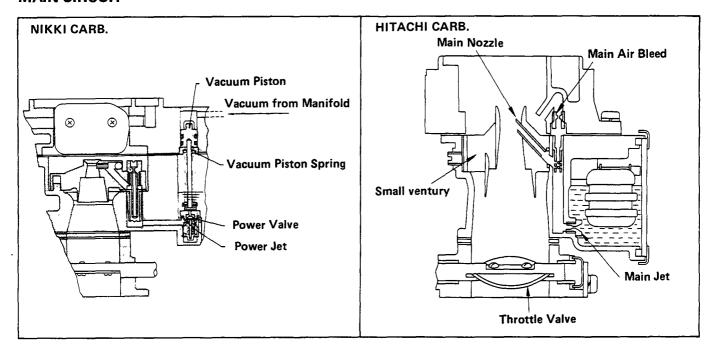
The float chamber maintains the fuel delivered by the fuel pump at a constant level.

### 08020802 SLOW SPEED CIRCUIT



During idling and slow speed operation, the throttle valve is almost completely closed. A minimum amount of air is flowing through the venturi. Negative pressure is very low. The main nozzle tip is above the fuel level in the float chamber. The main nozzle is unable to draw fuel resulting in greater fuel economy at low operating speeds.

08020803 MAIN CIRCUIT



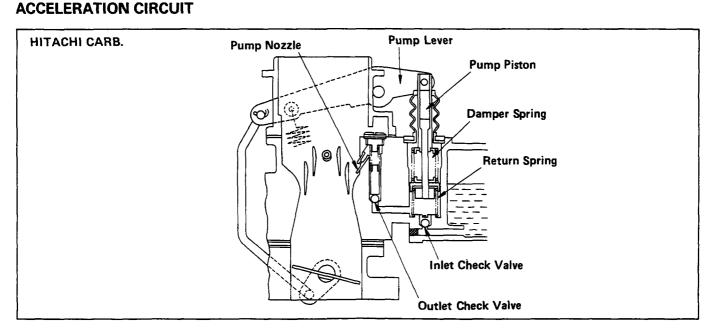
The main circuit is most often used during ordinary vehicle operation.

Opening the throttle valve beyond the specified angle increases the speed and volume of the air passing through the venturi. This results in a greater negative pressure.

The greater negative pressure draws fuel from the float chamber through the main air bleed into the emulsion tube. The emulsion tube mixes the fuel and air.

The air-fuel mixture then passes into the venturi through the main nozzle.

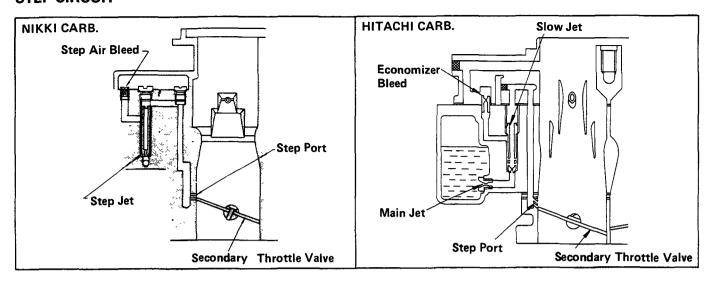
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During rapid acceleration, the throttle valve rapidly opens completely to draw in a large volume of air. Because there is insufficient fuel in the air horn, the resulting air-fuel mixture will be too lean. A flat spot will occur.

To prevent this flat spot, the accelerator pump forces fuel into the large venturi to produce a richer air-fuel mixture.

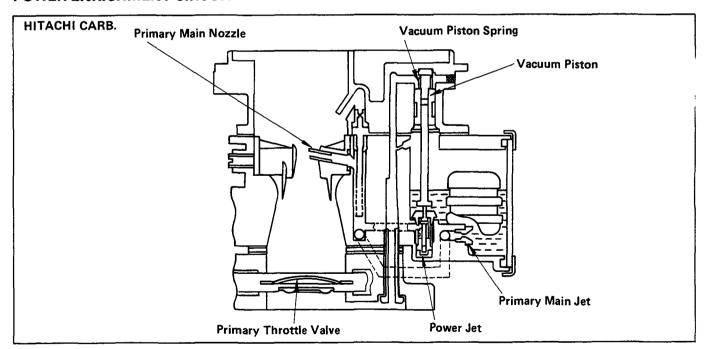
### STEP CIRCUIT



When the carburetor secondary side begins operation, there is an insufficient amount of air passing through the secondary side venturi. The resulting vacuum will not be strong enough to draw the required fuel from the secondary main nozzle. A momentary power loss will occur.

The step circuit acts to supplement the fuel mixture and maintain smooth engine performance.

### **POWER ENRICHMENT CIRCUIT**



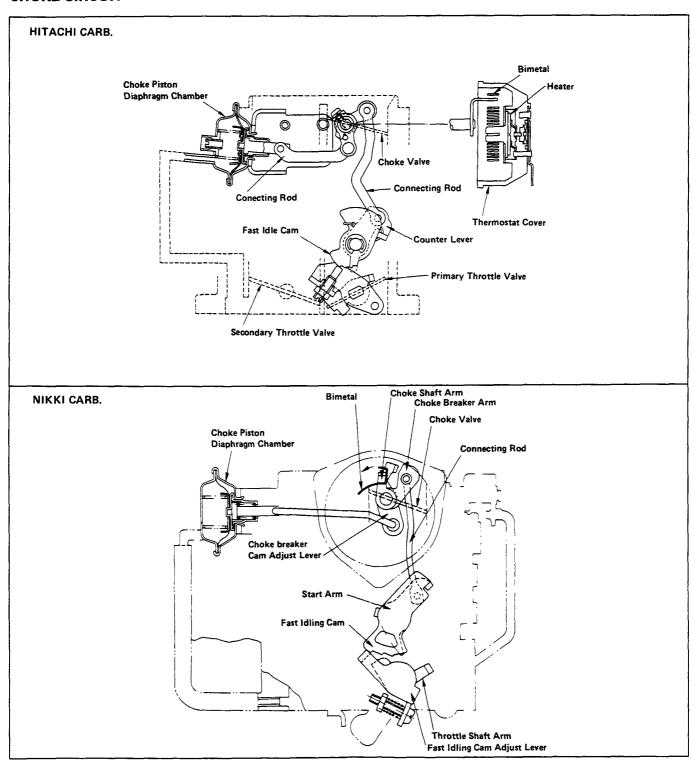
The power enrichment circuit prevents flat spots during rapid acceleration from a low speed.

During light-load running, the throttle valve is only slightly open. This results in a high intake manifold vacuum.

The high manifold vacuum pulls the vacuum piston upward to overcome the force of the vacuum piston spring and hold the power valve closed.

Suddenly opening the throttle valve during rapid acceleration causes the intake manifold vacuum to fall. The vacuum piston spring force is now greater than the force of the intake manifold vacuum. The vacuum piston is pushed down to open the power valve and allow additional fuel to reach the combustion chambers.

### **CHOKE CIRCUIT**



The auto choke consists of the eccentric choke valve, the spiral bimetal, the choke diaphragm, and the control rods.

The bimetal closes the choke valve.

The bimetal tension is inversely proportional to the surrounding temperatures. When the engine is cold, the bimetal tension forces the choke valve and the choke diaphragm closed. As the engine warms up, the bimetal tension drops and the choke valve opens.

The choke valve maintains the proper balance between the intake manifold negative pressure and the air horn air flow at all times. This assures stable engine operation.

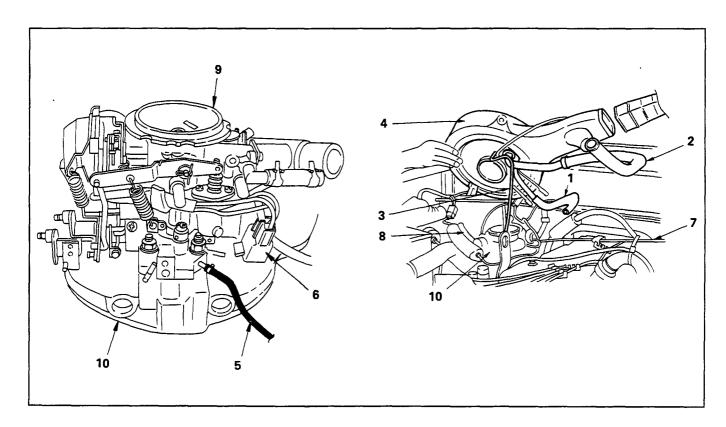
## **CARBURETOR**





## **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

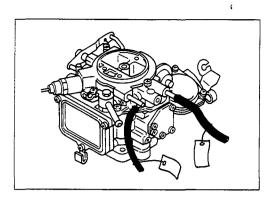


## **Removal Steps**

- 1. PCV hose
- 2. Air hose
- 3. TCA hose
- 4. Air cleaner
- ▲ 5. Emission control vacuum hose
  - 6. Lead wire connector
  - 7. Engine control cable
  - 8. Fuel hose
- ▲ 9. Carburetor
  - 10. Carburetor gasket

## Installation Steps

- ▲ 10. Carburetor gasket
- ▲ 9. Carburetor
  - 8. Fuel hose
- ▲ 7. Engine control cable
  - 6. Lead wire connector
- ▲ 5. Emission control vacuum hose
  - 4. Air cleaner
  - 3. TCA hose
  - 2. Air hose
  - 1. PCV hose



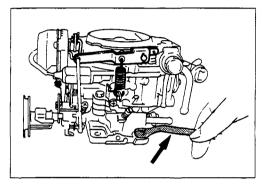


## Important Operations - Removal

### 5. Emission Control Vacuum Hoses

Tag each of the emission control vacuum hoses before disassembly.

This will ensure that the hoses are reconnected correctly.





### 9. Carburetor

Use the carburetor wrench to remove the carburetor.

Carburetor Wrench: 5-8511-9003-0 (J-26510)



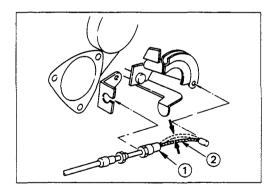
## Important Operations - Installation

### 5. Emission Control Vacuum Hoses

Refer to the tags attached at disassembly to reinstall the emission control vacuum hose.

Follow the external parts installation step order.

It is very important that the hose be installed correctly.



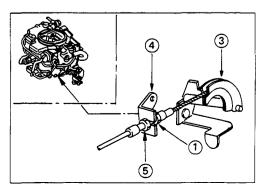
### 7. Engine Control Cable

- Fully close the throttle valve.
- Turn the adjusting nut ① to adjust the engine control inner cable ② play.

Engine Control Inner Cable Play

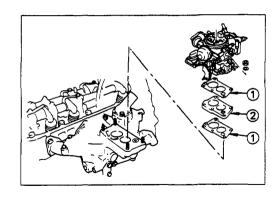
mm(in)

2 - 3(0.079 - 0.120)



- 3) Connect the engine control cable to the throttle holder ③.
- 4) Install the engine control cable to the bracket ④.
- 5) Tighten the lock nut 5.

### 6C-12 FUEL SYSTEM







### 9. Carburetor Gasket

### 10. Carburetor

- Install the gasket ①, heat insulator ② (If equipped), and the carburetor to the intake manifold.
  - Use the carburetor wrench to tighten the carburetor nuts to the specified torque.

Carburetor Wrench: 5-8511-9003-0 (J-26510)

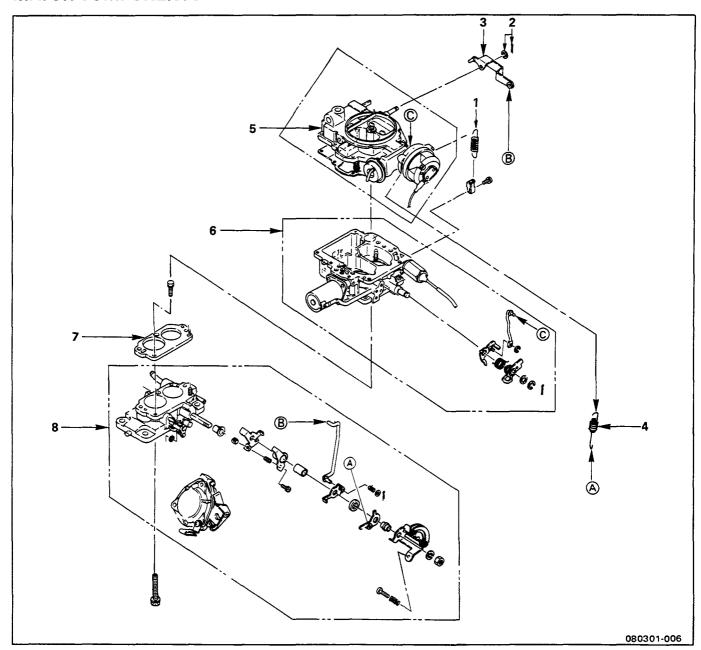
Carburetor Nut Torque	kg-m(lb.ft/N-m
1.3 ± 0.5 (9.4 ±	$3.6/12.7 \pm 4.9$ )



## (Nippon Kikai-Carburetor)

0803030002A

## **MAJOR COMPONENTS**



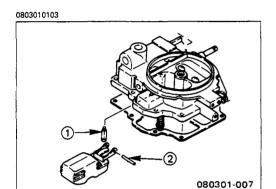
0803030002B

## **Disassembly Steps**

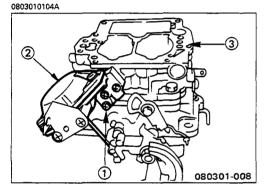
- 1. Throttle sub-return spring
- 2. Split pin and retaining ring
- 3. Accelerator pump arm
- 4. Primary to secondary spring
- ▲ 5. Air horn
- ▲ 6. Carburetor body
  - 7. Carburetor insulator
- ▲ 8. Flange

## $\overline{\mathbb{V}}$

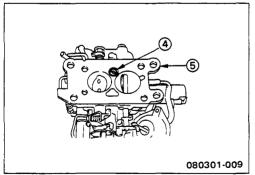
## **Important Operations**



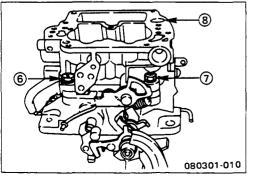
### \_\_\_\_



### 0803010104B



### 0803010104C



### 5. Air Horn

Do not allow the float valve seat ① and the float pin ② to fall free when separating the air horn from the carburetor flange.

These parts are very small and are easily lost. Handle them with care.

### 6. Carburetor Body

### 8. Flange

- 1) Loosen the three screws ①.
- 2) Remove the 2nd diaphragm chamber ② from the carburetor body ③.

3) Loosen the flange set screw (4) at the lower part of the flange (5).

### Note:

The hollow flange set screw also serves as the power valve negative pressure intake. Take care not to damage the screw and intake during the disassembly procedure.

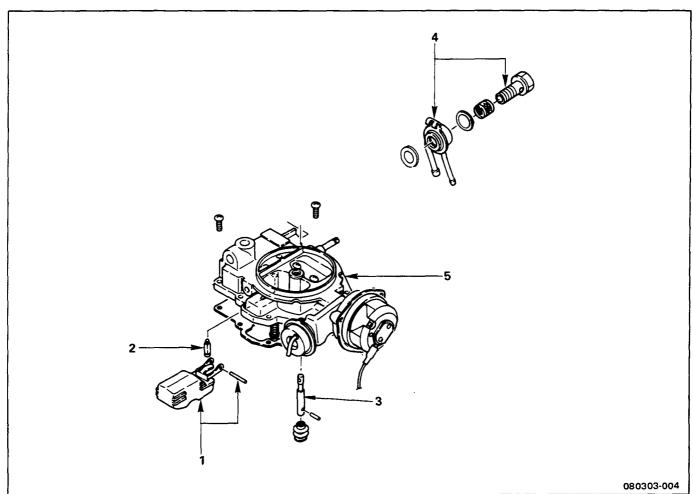
4) Loosen the bolt (a) and the nut (b) on the carburetor body (a).

## **MINOR COMPONENTS**

080303000301A



## **AIR HORN**



080303000301B

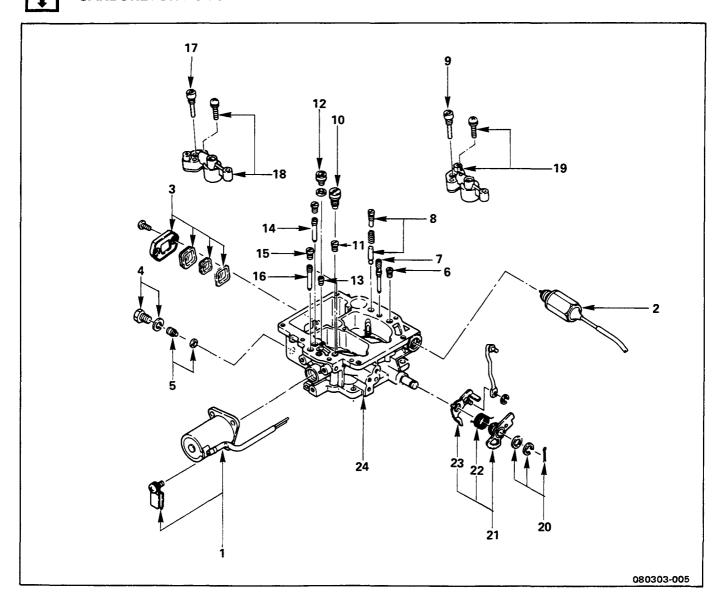
## **Disassembly Steps**

- 1. Float pin and float
- 2. Float valve
- 3. Accelerator plunger

- 4. Fuel connector
- 5. Air horn body with coil housing and choke piston

080303000302A

## **CARBURETOR BODY**



### 080303000302B

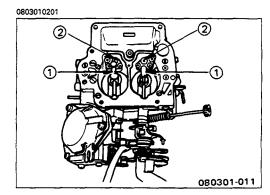
## **Disassembly Steps**

- 1. Coasting solenoid
- 2. Solenoid valve
- 3. Fuel level gauge cover and glass
- 4. Main passage plug
- 5. 2nd main jet
- 6. Slow air bleed jet
- 7. Slow jet
- 8. Carburetor pump spring and check valve seat
- 9. 1st main air bleed jet
- 10. Power jet
- 11. Slow passage plug
- 12. 1st main jet

- 13. Step air bleed jet
- 14. Step jet
- 15. 1st idle air bleed jet
- 16. Coasting jet
- 17. 2nd main air bleed jet
- ▲ 18. 2nd small venturi
- ▲ 19. 1st small venturi
  - 20. Split pin and clip
  - 21. Fast idling cam
  - 22. Fast idling cam spring
  - 23. Starting arm
  - 24. Carburetor body



## **Important Operations**



### 18. 2nd Small Venturi

### 19. 1st Small Venturi

Remove the small venturis ① after removing the 2nd and 1st main air bleed jets ②.



## INSPECTION AND REPAIR (NIKKI)

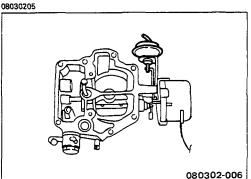
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

08030204

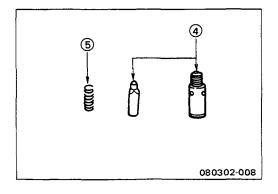


### Cleaning

- Carefully clean all of the disassembled parts (excluding the O-rings, the packing, the gaskets, and the electrical parts) with carburetor cleaner.
  - The parts are very delicate. Handle them with care.
- Use dry air to blow each of the carburetor passages free of foreign material.



# 08030206 (3) 080302-007



## Air Horn, Carburetor Body, and Flange

- Inspect the air horn, carburetor body, and flange fitting surfaces for cracks and other flaws.
  - If there are cracks or other flaws, the parts must be replaced.
- Inspect the shafts, the links, and the bushings for deformation and excessive wear.
  - If there is deformation or excessive wear, the parts must be replaced.

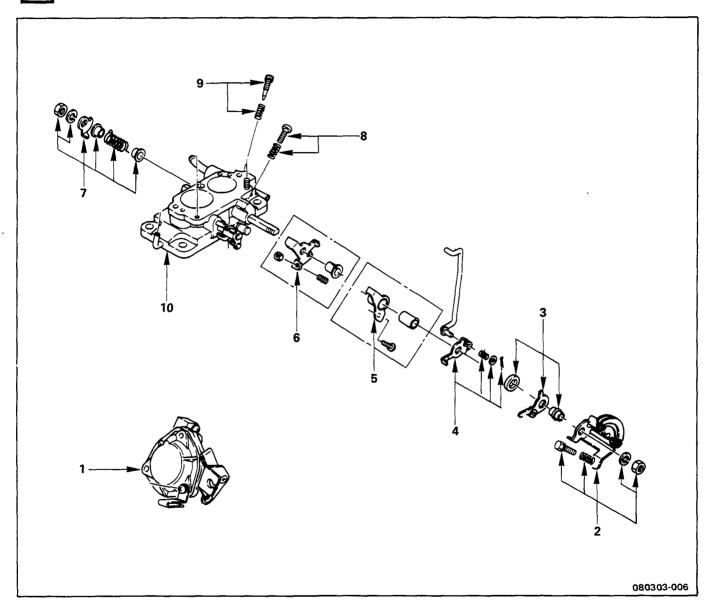
### Float and Float Valve

- Immerse the float in gasoline to clean it.
- Check the following parts for excessive wear and other damage.
  - ① Float
  - ② Float pin hole
  - 3 Float pin
  - Float valve seat and strainer
  - Spring (Resilience)





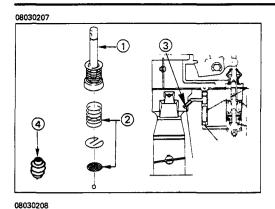
## **FLANGE**



080303000303B

## **Disassembly Steps**

- 1. 2nd diaphragm chamber
- 2. Throttle lever
- 3. Primary to secondary arm
- 4. Pump connector arm
- 5. Fast idling cam adjusting arm
- 6. Throttle shaft arm
- 7. Throttle return spring arm
- 8. Throttle adjusting screw
- 9. Idling adjusting screw
- 10. Flange

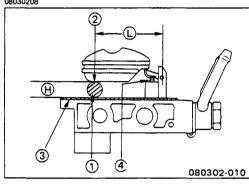




### **Accelerator Pump Plunger**

Check the following accelerator pump plunger parts for excessive wear and other damage.

- ◑ Plunger
- 2 Springs and strainer
- Pump nozzle
- Plunger boots





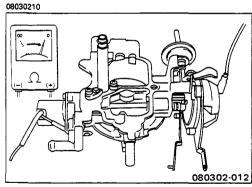
### Float Level Adjustment

Place the test bar ① between the float tip ② and the air horn gasket 3 as shown in the illustration.

The test bar should just fit into the space (H) between the float and the air horn gasket.

If the float level height is outside the specified range, adjust it by carefully bending the float arm 4 with your hands.

Float Arm Height (H)	mm(in)
8.5 - 9.5 (0.33 - 0.37)	
Float Pin Center to Float Tip (L) (Reference)	mm(in)
57 (2.24)	





## **Auto Choke Coil Housing**

Use an ohmmeter to measure the resistance between the choke coil wire and the coil housing.

If the measured value is outside the specified value, the coil housing must be replaced.

Auto Choke Coil Housing Resistance 6 ± 5 at 25°C (77°F) Ohms

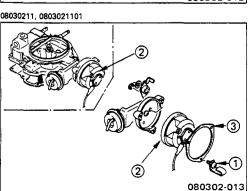


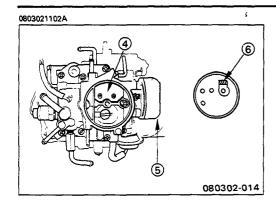
## **Auto Choke Coil Housing Replacement Coil Housing Removal**

- 1. Loosen the three coil housing installation screws ①.
- Remove the coil housing 2 together with the bimetal set case plate 3.

### Note:

Do not remove the auto choke coil housing unless it is to be replaced.

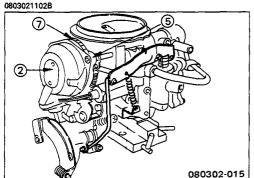






## **Coil Housing Installation**

- Fully close the choke valve 4.
- 2. Set the coil housing plate ⑤ choke shaft arm catch ⑥ perfectly horizontal.

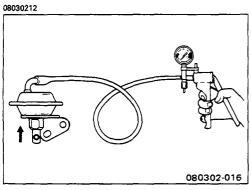




3. Set the bimetal with coil housing ② to the choke shaft arm.

Refer to the illustration.

- 4. Align the setting marks ⑦ on the coil housing plate ⑤ and the coil housing ②.
- 5. Install the coil housing together with the bimetal set case plate.





### **Choke Piston**

Apply a vacuum to the choke piston diaphragm.

The diaphragm should hold the vacuum for several seconds.

If it does not, the choke piston diaphragm must be replaced.

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## **Choke Piston Replacement**

### **Choke Piston Removal**

- 1. Remove the coil housing.
- 2. Remove the coil housing plate.
- Disconnect the choke piston rod clip from the choke shaft.

### Note:

Do not remove the choke piston unless it is to be replaced.

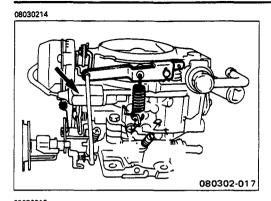
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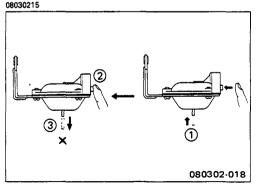
### Choke Piston Installation

Follow the removal procedure in the reverse order to install the choke piston.

0803021301B

### 6C-22 FUEL SYSTEM







### Slow Cut Solenoid Valve

- Check the slow cut solenoid valve body and spring spool for excessive wear and other damage.
- 2. Install the solenoid valve to the carburetor body.
- 3. Apply 12 Volts to the solenoid valve.

Check that the valve operates smoothly.

If the valve does not operate smoothly, it must be replaced.

## 2nd Diaphragm Chamber

1. Use your hand to push in the diaphragm chamber rod ①.

Block the diaphragm chamber hole ② with a finger at the same time.

2. Remove your finger from the hole.

The rod should not move.

If the rod moves, the diaphragm is damaged and must be replaced.



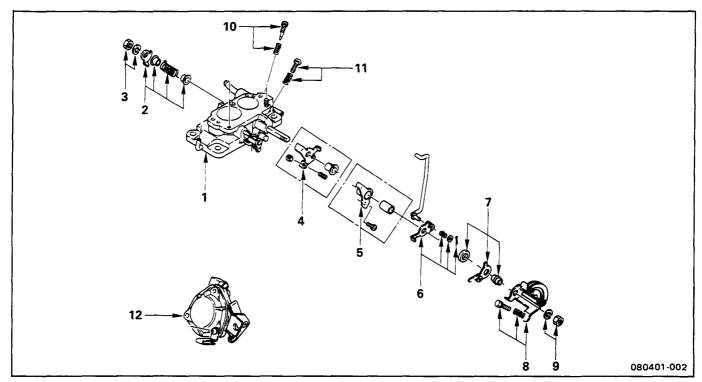
## **REASSEMBLY**

080401A

## MINOR COMPONENTS



## **FLANGE**



080401B

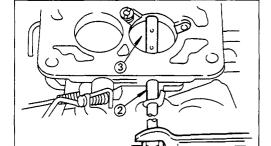
## **Reassembly Steps**

- 1. Flange
- ▲ 2. Spring arm nut
  - 3. Throttle return spring arm
  - 4. Throttle shaft arm
  - 5. Fast idling cam adjusting arm
  - 6. Pump connector arm

- 7. Primary to secondary arm
- 8. Throttle lever
- 9. Throttle lever nut
  - 10. Idling adjusting screw
  - 11. Throttle adjusting screw
  - 12. 2nd diaphragm chamber



## **Important Operations**



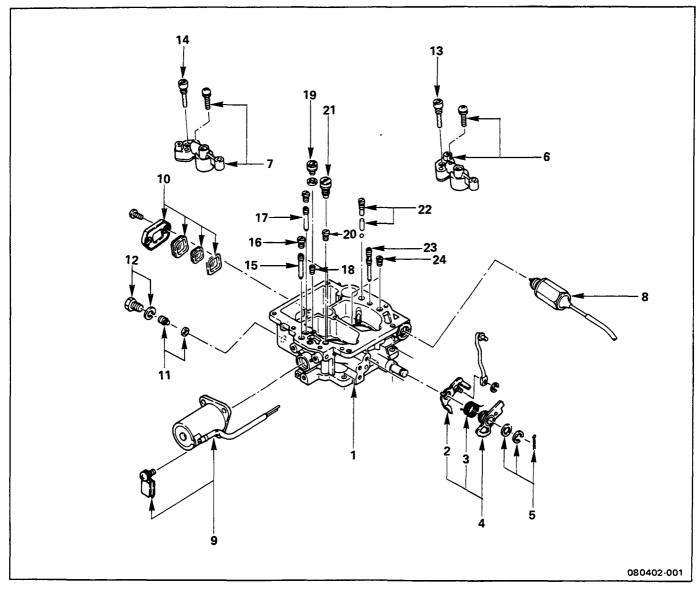
- 2. Spring Arm Nut
- 9. Throttle Lever Nut
- 1) Install the throttle lever nut ① to the throttle valve shaft ②.
- 2) Tighten the throttle lever nut to the related parts. Prevent the throttle valve shaft ② from turning.

### Note:

Failure to hold the throttle valve shaft stationary while tightening the throttle valve nut will result in damage to the throttle valve ③.



## **CARBURETOR BODY**



080402B

## Reassembly Steps

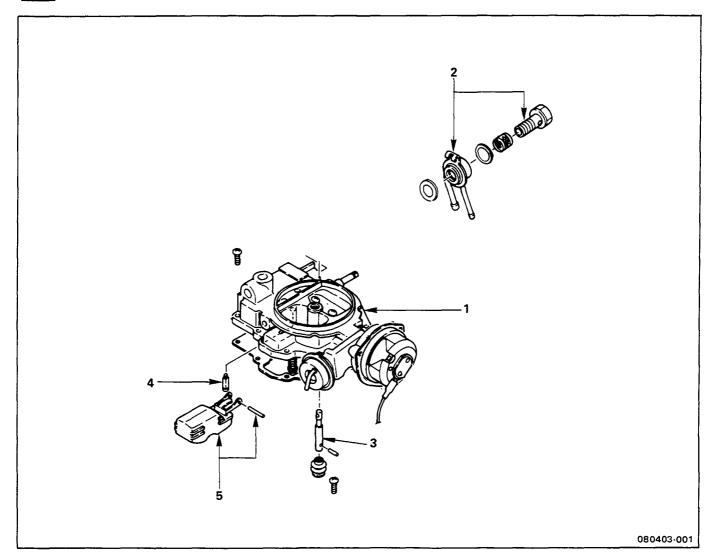
- 1. Carburetor body
- 2. Starting arm
- 3. Fast idling cam spring
- 4. Fast idling cam
- 5. Split pin and clip
- 6. 1st small venturi
- 7. 2nd small venturi
- 8. Solenoid valve
- 9. Coasting solenoid
- 10. Fuel level gauge cover and glass
- 11. 2nd main jet
- 12. Main passage plug

- 13. 1st main air bleed jet
- 14. 2nd main air bleed jet
- 15. Coasting jet
- 16. 1st idle air bleed jet
- 17. Step jet
- 18. Step air bleed jet
- 19. 1st main jet
- 20. Slow passage plug
- 21. Power jet
- 22. Carburetor pump spring and check valve
- 23. Slow jet
- 24. Slow air bleed jet

080403A



## **AIR HORN**



080402B

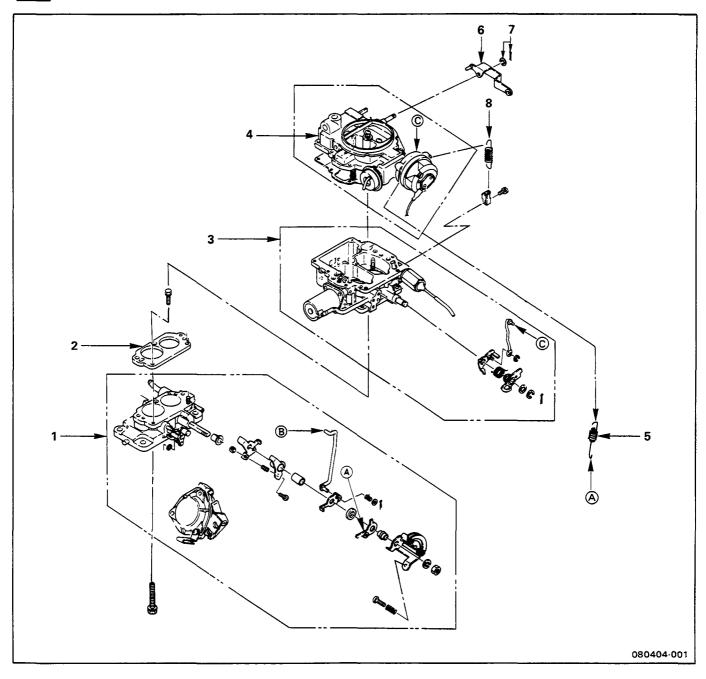
## **Reassembly Steps**

- 1. Air horn body with coil housing and choke piston
- 2. Fuel connector

- 3. Accelerator plunger
- 4. Float valve
- 5. Float pin and float



## **MAJOR COMPONENTS**

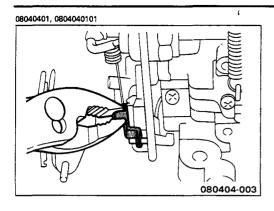


080402B

## **Reassembly Steps**

- 1. Flange
- 2. Carburetor insulator
- 3. Carburetor body
- 4. Air horn

- 5. Primary to secondary spring
- 6. Accelerator pump arm
- 7. Split pin and retaining ring
- 8. Throttle sub-return spring





### **CARBURETOR ADJUSTMENT**

### Secondary Throttle Valve Touch Angle

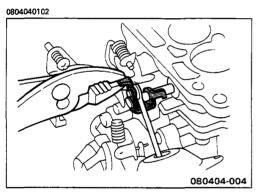
Inspect the primary throttle valve full opening when the secondary throttle valve is starting to open.

Use the throttle valve angle set gauge to check the primary throttle valve angle.

Valve Angle Set Gauge: 5-8840-2133-0

The throttle valve angle must match the gauge angle.

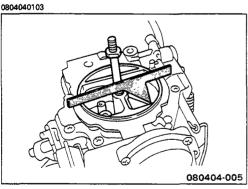
If the throttle valve angle does not match the gauge angle, adjust it by carefully bending the connecting pump arm.



## **Kick-Up Angle**

Check that the secondary valve opens just slightly  $(0^{\circ} - 2^{\circ})$  when the primary valve is fully open.

If the secondary valve opens too little or too much, adjust it by carefully bending the connecting pump arm.



## Q

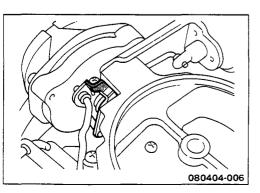
### **Choke Valve Angle**

- 1. Fully open the primary throttle valve.
- 2. Use the choke valve angle set gauge to check the choke valve angle.

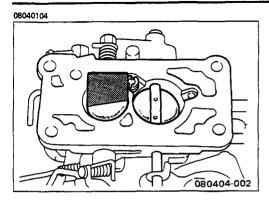
Choke Valve Angle Set Gauge: 5-8840-2132-0

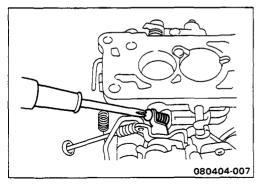
The choke valve angle must match the gauge angle.

If the choke valve angle does not match the gauge angle, adjust it by carefully bending the choke valve adjusting lever.



### 6C-28 FUEL SYSTEM







## **Fast Idling Setting**

- Set the throttle shaft lever to the first step of the fast idle cam.
- 2. Fully close the choke valve.
- 3. Use the fast idling set gauge to check the primary throttle valve angle.

Fast Idling Set Gauge: 5-8840-2131-0

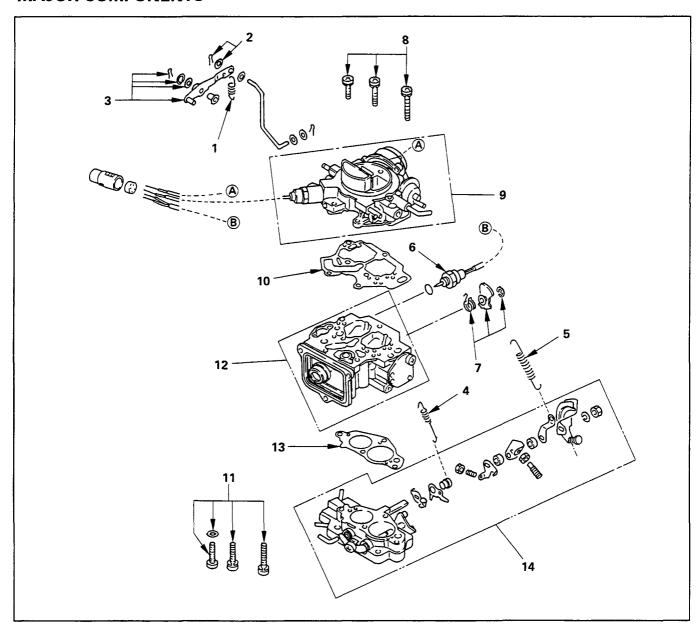
The primary throttle valve angle must match the gauge angle.

If the primary throttle valve angle does not match the gauge angle, adjust it with the fast idling adjusting screw.

# DISASSEMBLY

## (Hitachi-Carburettor, 4ZE1 Engine)

## **MAJOR COMPONENTS**



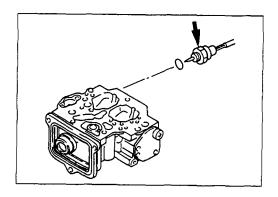
## **Disassembly Steps**

- 1. Assist spring
- 2. Pump rod split pin with washer
- 3. Pump lever and split pin with washer
- 4. Return spring
- 5. Main spring
- ▲ 6. Slow cut solenoid valve
- ▲ 7. Fast idler cam and spring

- 8. Choke chamber screw and washer
- ▲ 9. Choke chamber assembly
  - 10. Choke and float chamber gasket
  - 11. Throttle chamber screw and washer
  - 12. Float chamber assembly
  - 13. Float and throttle chamber gasket
  - 14. Throttle chamber assembly



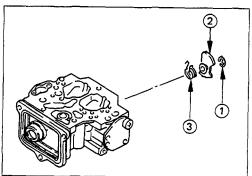
## **Important Operations**



## 6. Slow Cut Solenoid Valve

Disconnect the slow cut solenoid valve before disassembling the choke chamber.

Take care not to damage the solenoid valve tip.



## 7. Fast Idler Cam and Spring

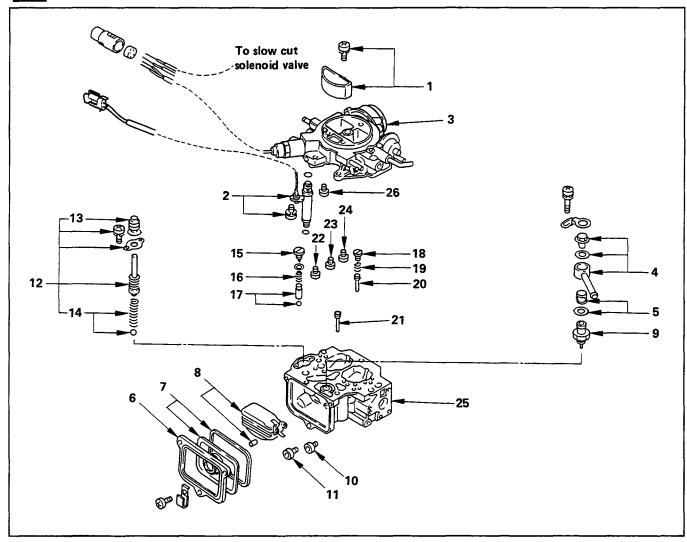
## 9. Choke Chamber Assembly

Remove the split pin ①, the fast idler cam ②, and the cam spring ③ from the float chamber shaft.

## MINOR COMPONENTS



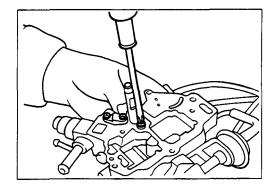
### CHOKE CHAMBER AND FLOAT CHAMBER ASSEMBLY



## **Disassembly Steps**

- 1. Vent cover
- ▲ 2. Duty solenoid valve
  - 3. Choke chamber
  - 4. Fuel nipple
  - 5. Fuel filter
  - 6. Level gauge cover
  - 7. Level gauge and rubber seal
- ▲ 8. Float and collar
- ▲ 9. Needle valve
  - 10. Secondary main jet
  - 11. Primary main jet
- ▲ 12. Piston
  - 13. Pump cover

- 14. Piston return spring
- 15. Pump set screw
- 16. Injector spring
- 17. Injector weight
- 18. Taper plug
- 19. Slow jet spring
- 20. Primary slow jet
- 21. Secondary slow jet
- 22. Primary main air bleed
- 23. Secondary main air bleed
- 24. Primary slow air bleed
- 25. Float chamber
- ▲ 26. Power jet



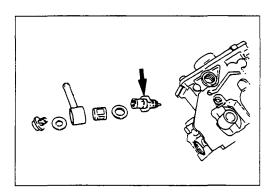


## **Important Operations**

- 2. Duty Solenoid Valve ('91 Swiss, Sweden & '92 Germany models)
- 1) Cut the solenoid valve cord.
- 2) Loosen the three screws holding the valve in place.
- 3) Pull the valve from the choke chamber.

### Note:

Do not remove the duty solenoid valve unless repair or replacement is required.



### 8. Float and Collar

### 9. Needle Valve

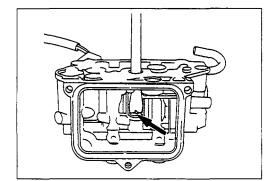
Take care not to lose the collar.

Do not allow the needle valves to fall free.

Take care not to damage the needle valve.

### 12. Piston

Take care not to lose the check ball.

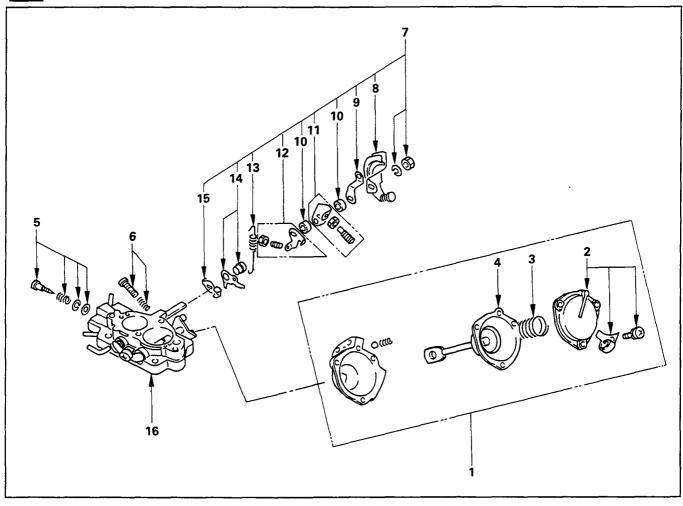


## 26. Power Jet (Except '91 model, Swiss & Sweden, '92 model, Germany)

Be sure to place a screwdriver properly into the slot to prevent valve rod damage.



## THROTTLE CHAMBER ASSEMBLY



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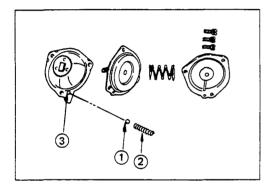
# **Disassembly Steps**

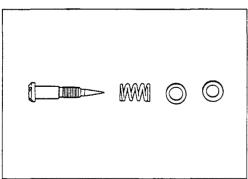
- 1. Diaphragm chamber assembly
- ▲ 2. Diaphragm chamber cover
- ▲ 3. Diaphragm spring
- ▲ 4. Diaphragm
- ▲ 5. Idler adjusting screw
  - 6. Throttle adjusting screw
- ▲ 7. Throttle shaft nut and washer
- ▲ 8. Throttle lever

- ▲ 9. Spring hanger
- ▲ 10. Shaft collar
- ▲ 11. Fast idler adjusting lever and screw
- ▲ 12. Kick lever
- ▲ 13. Return spring
- ▲ 14. Return plate and sleeve
- ▲ 15. Adjusting lever
  - 16. Throttle chamber



# **Important Operations**





#### 2. Diaphragm Chamber Cover

- 3. Diaphragm Spring
- 4. Diaphragm

Do not allow the ball ① and the spring ② to fall from the diaphragm chamber vacuum hole ③ during the disassembly procedure.

Take care not to lose or misplace the disassembled parts.

#### 5. Idler Adjusting Screw

Take care not to damage the adjusting screw tip after disassembly.

# 7. Throttle Shaft Nut and Washer

Remove the steps number 7 to 15 parts only if repair or replacement is required.



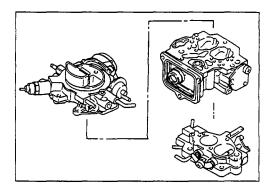
# **INSPECTION AND REPAIR (HITACHI)**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



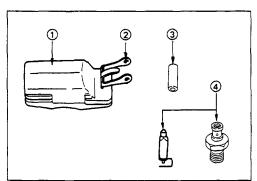
#### Cleaning

- Carefully clean the disassembled parts (excluding the O-rings, the gaskets, and the electrical parts) with carburetor cleaner.
  - Carburetor parts are extremely delicate. Handle them carefully to avoid damage.
- 2. Use dry air to blow each of the carburetor passages free of foreign material.



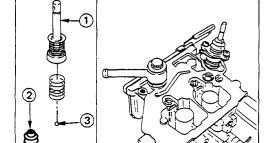
# Choke Chamber, Float Chamber, and Throttle Chamber

- Insert the choke chamber, the float chamber, and the throttle chamber fitting surfaces for cracks or other flaws.
  - If there are cracks or other flaws, the parts must be replaced.
- 2. Inspect the shafts and the links for deformation and excessive wear.
  - If there is deformation and excessive wear, the parts must be replaced.



#### Float and Needle Valve

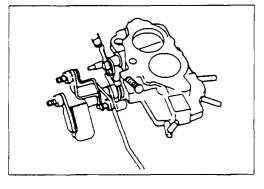
- 1. Immerse the float and needle valve in gasoline to clean them.
- 2. Check the following parts for excessive wear and damage.
  - ① Float
  - ② Float pin hole
  - 3 Float pin dollar
  - Needle valve and seat

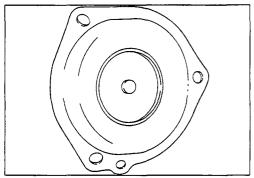


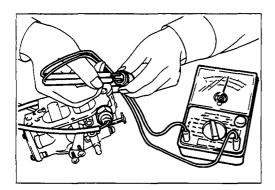
#### **Piston**

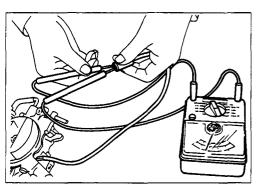
Inspect the piston ① and the piston boot ② for excessive wear and damage.

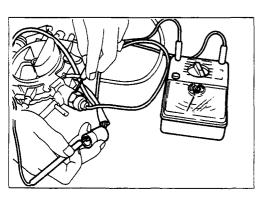
Take care not to lose the check ball 3.











#### Throttle Chamber

- 1. Inspect the slow port, the idle port, and the other throttle chamber openings for restrictions.
- 2. Inspect the primary throttle valve and the secondary throttle valve for carbon deposits and excessive wear.
- 3. Inspect the throttle valve shaft for wear.
- 4. Inspect the idler adjusting screw seating faces for step wear.

Inspect the threads for damage.

## Diaphragm

Inspect the diaphragm for deterioration and damage.



#### Slow Cut Solenoid Valve

- Inspect the slow cut solenoid valve body and spring spool for excessive wear and damage.
- 2. Use an ohmmeter to measure the resistance between the solenoid valve positive terminal and negative terminal.

If the measured resistance is outside the specified range, the slow cut solenoid valve must be replaced.

Slow Cut Solenoid Valve Resistance

Ohms

31.9 - 43.3 at 20°C (68°F)



# Duty Solenoid Valve (From '91 Swiss & Sweden, '92 Germany models)

Use an ohmmeter to measure the resistance between the solenoid valve positive terminal and negative terminal.

If the measured resistance is outside the specified range, the rear holder and the connectors) must be replaced.

**Duty Solenoid Valve Resistance** 

Ohms

34.7 - 46.9 at 20°C (68°F)



#### Switch Vent Solenoid Valve (If equipped)

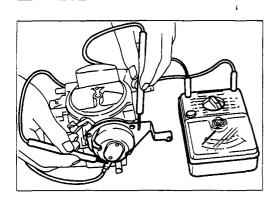
Use an ohmmeter to measure the resistance between the solenoid valve positive terminal and ground (valve body).

If the measured resistance is outside the specified range, the switch vent solenoid valve must be replaced.

Switch Vent Solenoid Valve Resistance

Ohms

25.1 - 34.1 at 20°C (68°F)





#### Thermostat

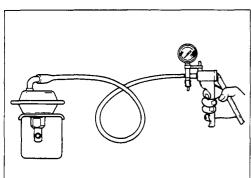
Use an ohmmeter to measure the resistance between the thermostat positive terminal and ground (thermostat body).

If the measured resistance is outside the specified range, the thermostat must be replaced.

Thermostat Resistance

Ohms

1.1 - 3.1 at 20°C (68°F)

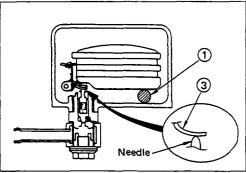


#### Choke Piston

Apply a vacuum to the choke piston diaphragm.

The diaphragm must maintain the vacuum for several seconds.

If it does not, the choke chamber assembly must be replaced.





#### **MEASUREMENT AND ADJUSTMENT**

#### 1. Float Level Adjustment



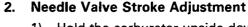
Place the test bar ① between the float tip and the upper face of float chamber as shown in the illustration.

If the float level height is outside the specified range, adjust it by carefully bending the float seat 3 with your hands.

Float Level Height

mm (in)

7.2 (0.28)



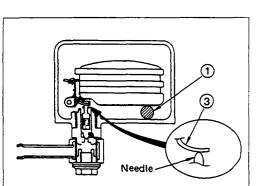
- 1) Hold the carburetor upside down.
- 2) Fully riase the float ①.
- Measure the clearance between the valve stem 2 (resting at the bottom position) and the float seat 3.

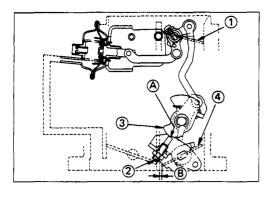
If the needle valve stroke is outside the specified value, adjust the needle valve stroke by carefully bending the float stopper.

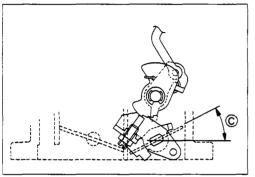
Valve Stem and Float Seat Clearance

mm (in)

1.5 (0.059)









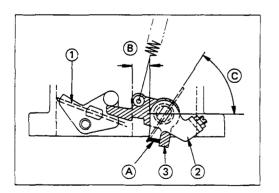
## Fast Idling

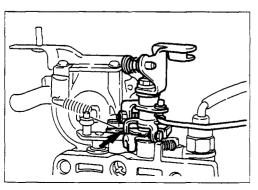
- 1. Fully close the choke valve ①.
- 2. Align the fast idling screw ② with the fast idling cam ③ first step ④.
- 3. Measure the clearance ® between the primary throttle valve ④ and the throttle valve chamber wall.

If the measured clearance is outside the specified range, adjust it with the idling adjusting screw ②.

Throttle Valve and Throttle Valve Chamber Wall Clearance	mm(in)
1.23 - 1.48 (0.048 - 0.058)	
(Reference)	
Primary Throttle Valve Angle ©	Deg.
25	

\* When the clearance between the throttle valve and the throttle valve chamber wall is within the specified range.







# Primary Throttle Valve and Secondary Throttle Valve Interlock



- Measure the clearance ® between the throttle valve and the throttle valve chamber wall.

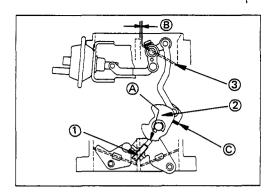
If the measured clearance is outside the specified range, adjust it by carefully bending the kick lever tang.

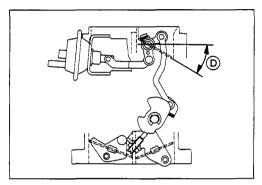
Throttle Valve and Throttle Valve Chamber
Wall Clearance ® mm(in)
6.9 - 8.4 (0.27 - 0.33)

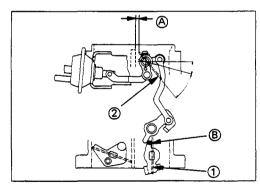


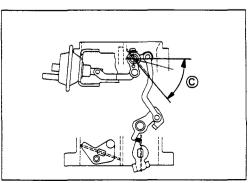
Primary Throttle Valve Angle © Deg.

\* When the clearance between the primary throttle valve and the throttle valve chamber wall is within the specified range.













#### **Choke Valve Opening**

- 1. Move the fast idling screw ① tip against the fast idling cam ② second step ②.
- 2. Measure the clearance ® between the choke valve 3 and the choke valve chamber wall.

If the measured clearance is outside the specified range, adjust it by carefully bending the counter lever tang ©.

Choke Valve and Choke Valve Chamber Wall Clearance

mm(in)

0.8 - 1.3 (0.03 - 0.05)

#### (Reference)

Choke Valve Angle (D)

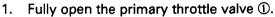
Deg.

30

\* When the clearance between the choke valve and the choke valve chamber wall is within the specified range.



# Unloader





2. Measure the clearance (a) between the choke valve (2) and the choke valve chamber wall.

If the measured clearance is outside the specified range, adjust it by carefully bending the adjusting lever tang (B).

Choke Valve and Choke Valve Chamber
Wall Clearance

mm(in)

2.7 - 3.3 (0.11 - 0.13)

## (Reference)

Choke Valve Angle ©

Deg.

50

\* When the clearance between the choke valve and the choke valve chamber wall is within the specified range.

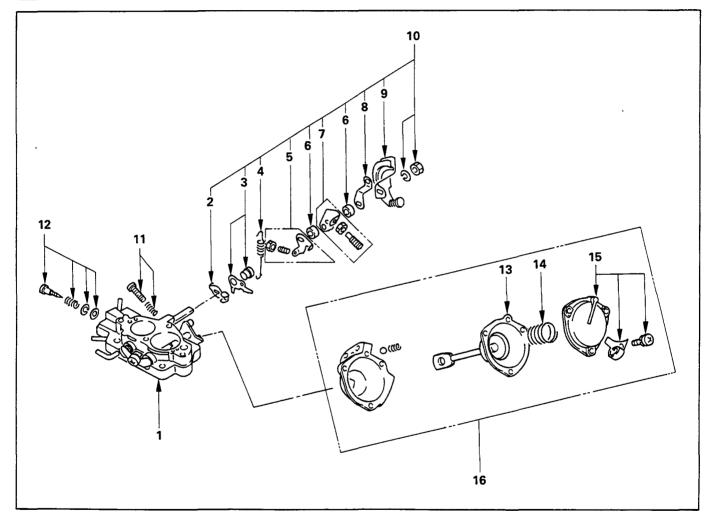
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# MINOR COMPONENTS



#### THROTTLE CHAMBER ASSEMBLY



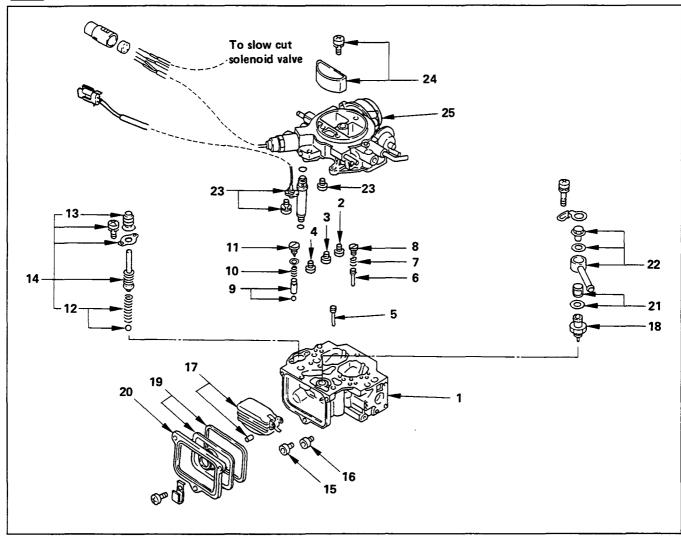
# **Reassembly Steps**

- 1. Throttle chamber
- 2. Adjusting lever
- 3. Return plate and sleeve
- 4. Return spring
- 5. Kick lever
- 6. Shaft collar
- 7. Fast idler adjusting lever and screw
- 8. Spring hanger

- 9. Throttle lever
- 10. Throttle shaft nut and washer
- 11. Throttle adjusting screw
- 12. Idler adjusting screw
- 13. Diaphragm
- 14. Diaphragm spring
- 15. Diaphragm chamber cover
- 16. Diaphragm chamber assembly



#### CHOKE CHAMBER AND FLOAT CHAMBER ASSEMBLY



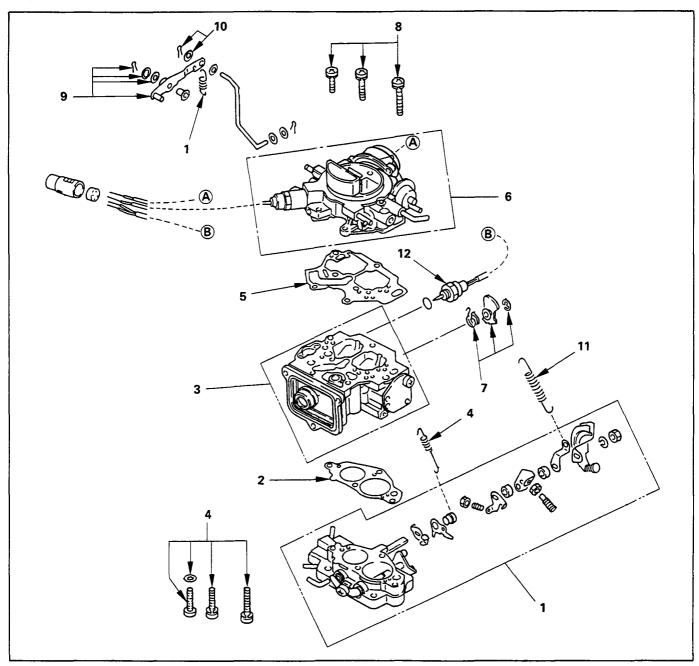
# **Reassembly Steps**

- 1. Float chamber
- 2. Primary slow air bleed
- 3. Secondary main air bleed
- 4. Primary main air bleed
- 5. Secondary slow jet
- 6. Primary slow jet
- 7. Slow jet spring
- 8. Taper plug
- 9. Injector weight
- 10. Injector spring
- 11. Pump set screw
- 12. Piston return spring
- 13. Pump cover

- 14. Piston
- 15. Primary main jet
- 16. Secondary main jet
- 17. Float and collar
- 18. Needle valve
- 19. Level gauge and rubber seal
- 20. Level gauge cover
- 21. Fuel filter
- 22. Fuel nipple
- 23. Duty solenoid valve or power jet
- 24. Vent cover
- 25. Choke chamber



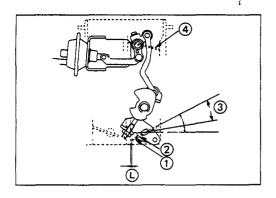
# **MAJOR COMPONENTS**



# **Reassembly Steps**

- 1. Throttle chamber assembly
- 2. Float and throttle chamber gasket
- 3. Float chamber assembly
- 4. Throttle chamber screw and washer
- 5. Choke and float chamber gasket
- 6. Choke chamber assembly
- 7. Fast idler cam and spring

- 8. Choke chamber screw and washer
- 9. Pump lever and split pin with washer
- 10. Pump rod split pin with washer
- 11. Main spring
- 12. Slow cut solenoid valve





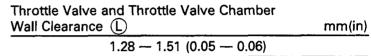
# CARBURETOR ADJUSTMENT (Hitachi-Carburetor)

#### **Primary Throttle Valve**

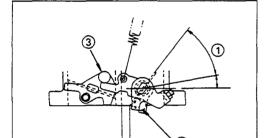
The fast idling adjusting screw ① should open the primary throttle valve ② to an angle of 15° ③ when the choke valve ④ is completely closed.

Check and adjust the primary throttle valve opening angle as follows:

- 1) Close the choke valve (4) completely.
- 2) Turn the throttle stop screw all the way in.
- Measure the clearance between the primary throttle valve and the throttle valve chamber wall at the center of the throttle valve.



If required, use the fast idling adjusting screw to adjust the clearance.





#### Linkage

When the primary throttle valve is opened to an angle of 47° ①, the adjusting plate (interlocked with the primary throttle valve) makes contact with the kick lever at point ②.

Further opening the primary throttle valve pulls the return plate away from the stopper ③, allowing the secondary throttle valve to open.

Check and adjust the secondary throttle valve opening point as follows:

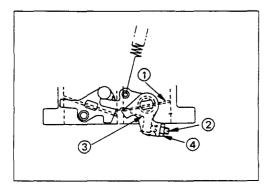
1) Measure the clearance between the primary throttle valve and the throttle valve chamber wall at the center of the throttle valve.

The adjusting plate must be contacting the kick lever at point ②.

2) If required, adjust the clearance by carefully bending the kick lever at point ②.

#### **Kick Lever**

- Turn out the throttle adjusting screw until the primary throttle valve ① is completely closed.
- 2) Loosen the lock nut on the kick lever screw 2.
- 3) Turn the kick lever screw until it makes contact with the return plate 3.
- 4) Tighten the lock nut 4.



# **FUEL PUMP**



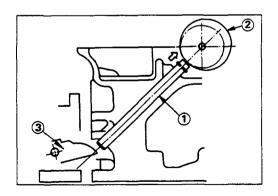


# REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



Important Operations — Installation





#### ▲ Fuel Pump

- 1) Remove the cylinder head cover.
- 2) Place the No. 4 piston at top dead center.
- 3) Lift the push rod 1 toward the camshaft 2.
- Hold the push rod in the raised position.

  4) Install the fuel pump ③.
- 5) Tighten the fuel pump bolts to the specified torque.

Fuel Pump Bolt Torque

kg-m(lb.ft/N-m)

 $2.7 \pm 0.5 (19.5 \pm 3.6/26.5 \pm 4.9)$ 

#### Note:

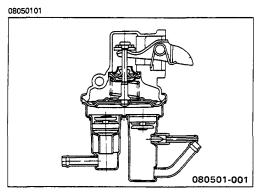
Start the engine and check for oil leakage around the gaskets and fuel leakage from the hose joints.

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# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



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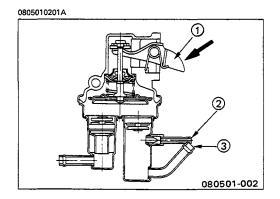
#### **Fuel Pump External Inspection**

- 1. Check the outside of the fuel pump for cracks and other damage.
  - Replace the fuel pump if cracks or other damage are discovered.
- Check for excessive wear between the rocker arm and the camshaft contact faces.
  - If there is excessive wear, the fuel pump must be replaced.

#### **Fuel Pump Internal Inspection**

Perform following steps before beginning the inspection procedure.

- 1. Pour a small amount of clean fuel into the fuel pump.
- 2. Moisten the valve seal with clean fuel.



#### Inlet Valve

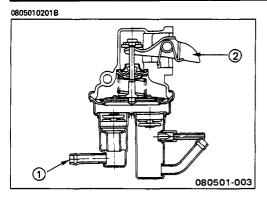
- 1. Move the rocker arm ① toward the pump and hold it in that position.
- 2. Block the return pipe ② and the outlet pipe ③ with your fingers.
- 3. Carefully push the rocker arm back to its original position.

Your fingers must be blocking the pipes at this time.

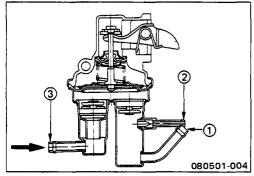
There should be a marked increase in rocker arm play after the rocker arm is returned to its original position.

If there is not a marked increase in rocker arm play, the fuel pump must be replaced.

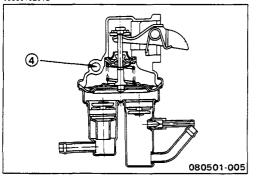
#### 6C-46 FUEL SYSTEM







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#### **Outlet Valve**

- 1. Block the inlet pipe ① with your fingers.
- Move the rocker arm ② to check for excessive play.
   The fuel pump must be replaced if there is excessive play.

#### Note:

Do not apply too much force to the rocker arm.



#### Diaphragm

- 1. Block the outer pipe ① and the return pipe ②.
- 2. Use a leak tester to apply 0.3 kg/cm<sup>2</sup> (4.3 psi/29.4 kPa) of air pressure to the inlet pipe ③.
- 3. Release the leak tester handle.

There should be no sudden drop in air pressure. If there is a sudden drop in air pressure, the fuel pump must be replaced.

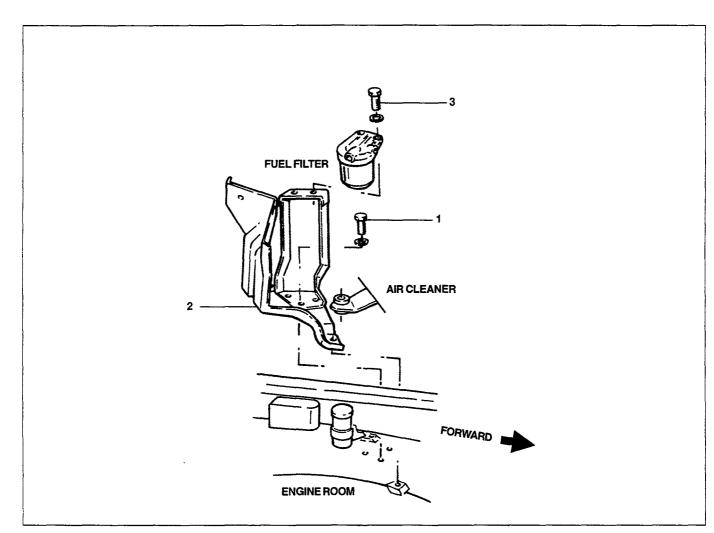


#### Oil Seal

- Use a leak tester to apply 0.1 kg/cm² (1.4 psi/9.8 kPa) of air pressure to the air pipe ④.
- 2. Release the leak tester handle.

There should be no sudden drop in air pressure. If there is a sudden drop in air pressure, the fuel pump must be replaced.

# FUEL FILTER REMOVAL AND INSTALLATION



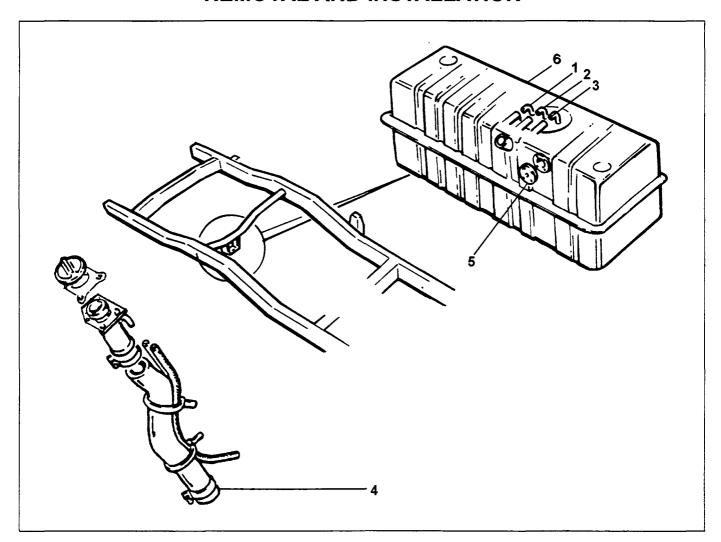
# **Removal Steps**

- 1. Bolt; Bracket to body
- 2. Bracket; Fuel filter
- 3. Bolt; Fuel filter

# **Installation Steps**

- 3. Bolt; Fuel filter
- 2. Bracket; Fuel filter
- 1. Bolt; Fuel filter

# FUEL TANK REMOVAL AND INSTALLATION



# **Removal Steps**

- 1. Breather hose
- 2. Fuel delivery hose
- 3. Fuel return hose
- 4. Filler neck hose
- 5. Fuel tank unit
- 6. Tank ASM

# **Installation Steps**

- 6. Tank ASM
- 5. Fuel tank unit
- 4. Filler neck hose
- 3. Fuel return hose
- 2. Fuel delivery hose
- 1. Breather hose



# **INSPECTION AND REPAIR**

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

#### Fuel rubber hose

- Evaporator rubber hose
- Fuel filter hose

#### **Visual Check**

Check the parts listed at the left for excessive wear and damage.

# **TROUBLESHOOTING**

Refer to this Section to quickly diagnose and repair fuel system problems. Each troubleshooting chart has three headings arranged from left to right.

(1) Checkpoint (2) Trouble Cause (3) Countermeasure

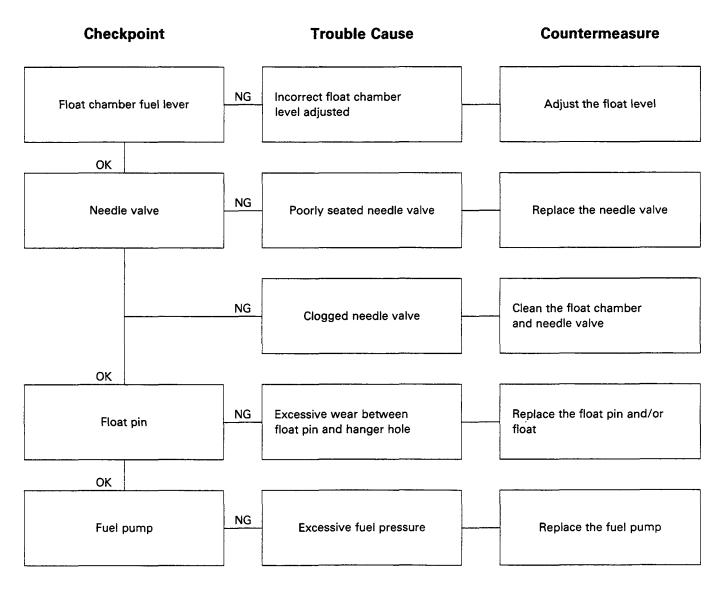
This Section is divided into seven sub-sections:

- 1. Fuel Over Flowing
- 2. Fuel Not Reaching Float Chamber
- 3. Unstable Idling
- 4. Excessive Fuel Consumption
- 5. Insufficient Power
- 6. Flat Spot on Accereleration
- 7. Flat Spot on High Speed Operation

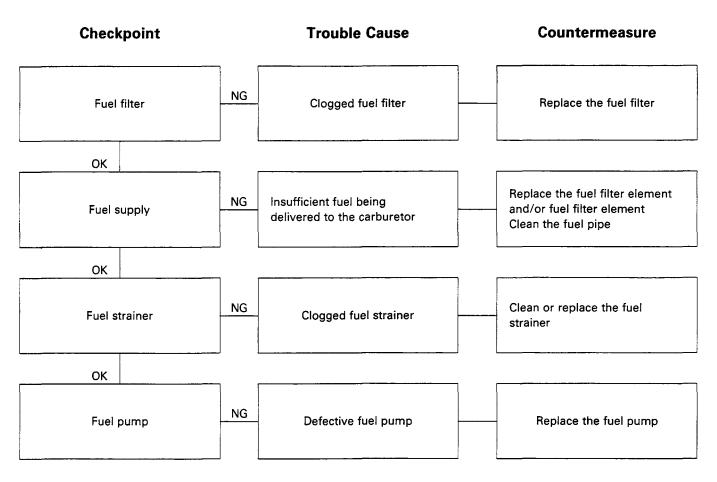
#### Note:

V : Variation (Optional on some models)

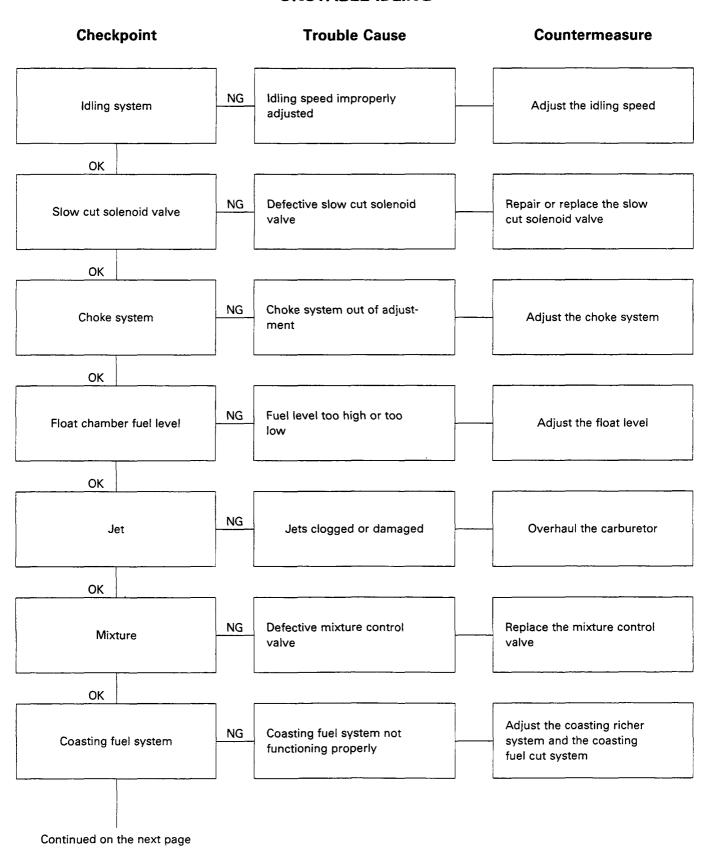
## **FUEL OVER FLOWING**

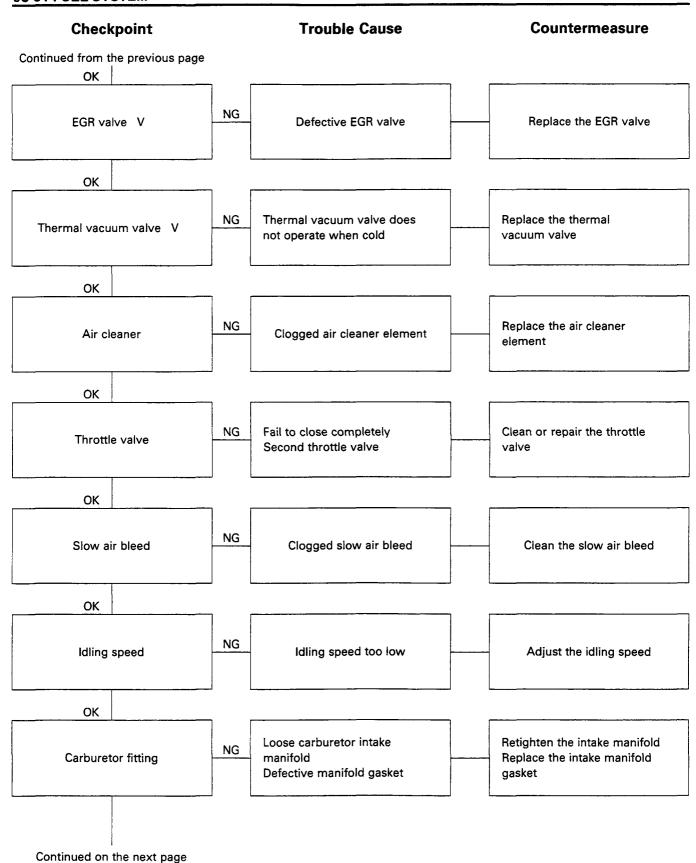


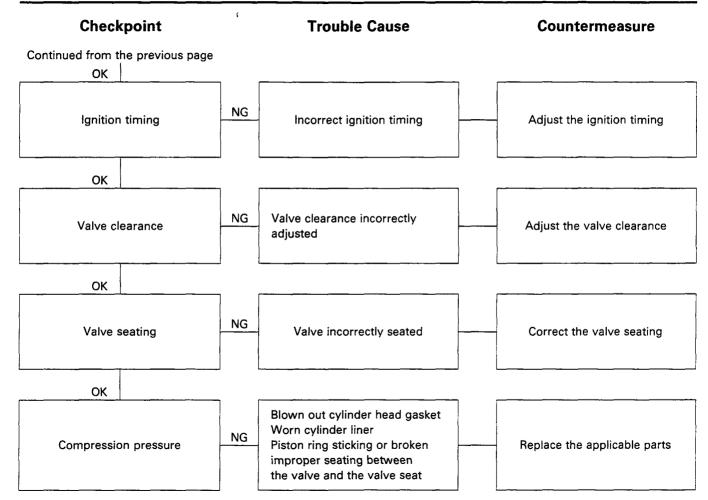
# **FUEL NOT REACHING FLOAT CHAMBER**



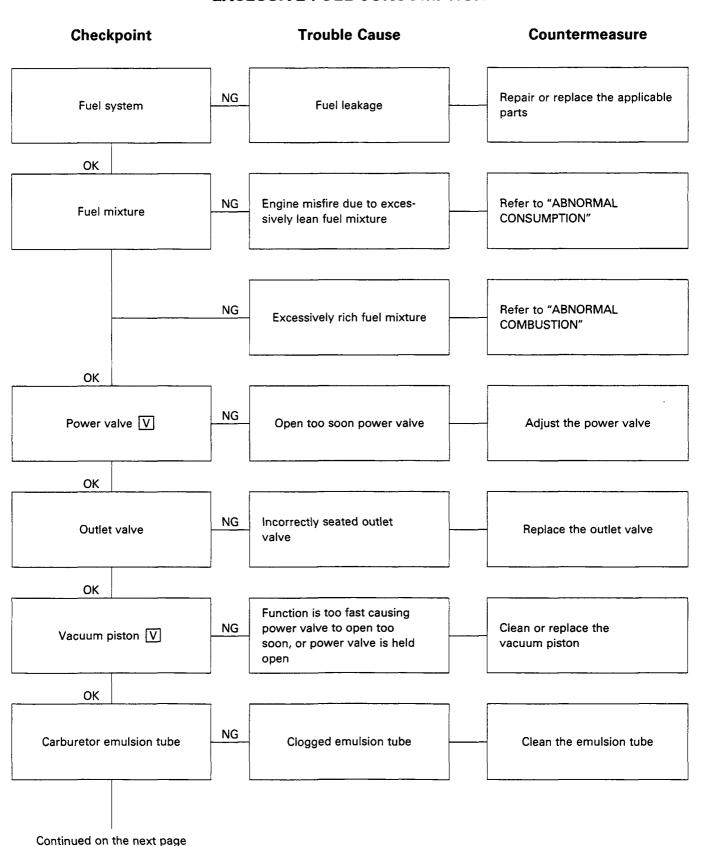
# **UNSTABLE IDLING**



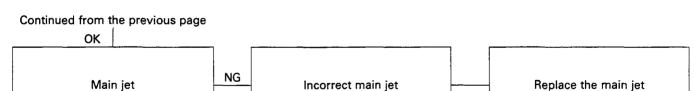




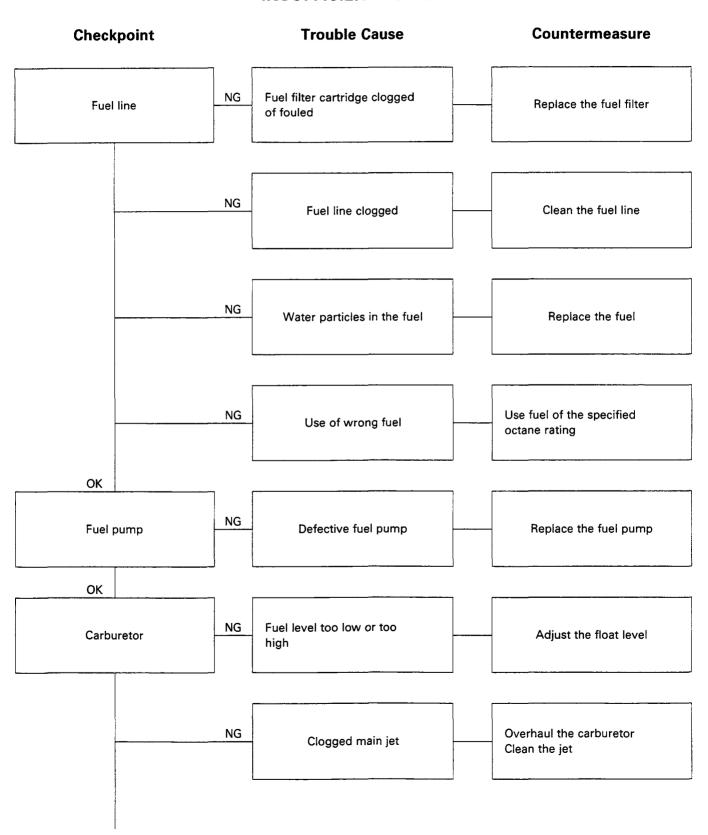
#### **EXCESSIVE FUEL CONSUMPTION**

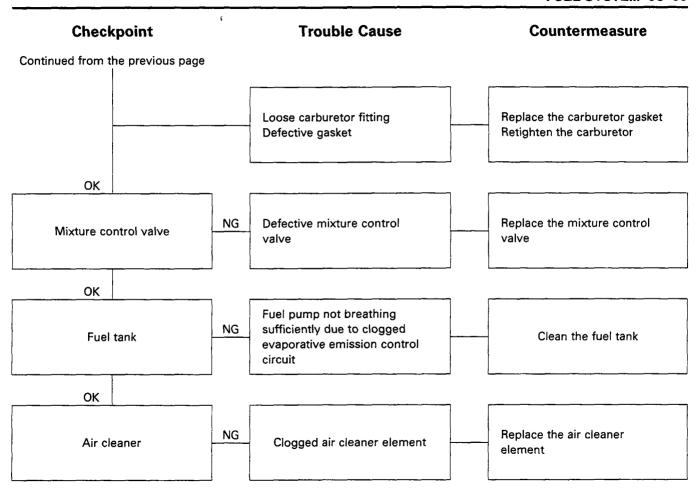


FUEL SYSTEM 6C-57

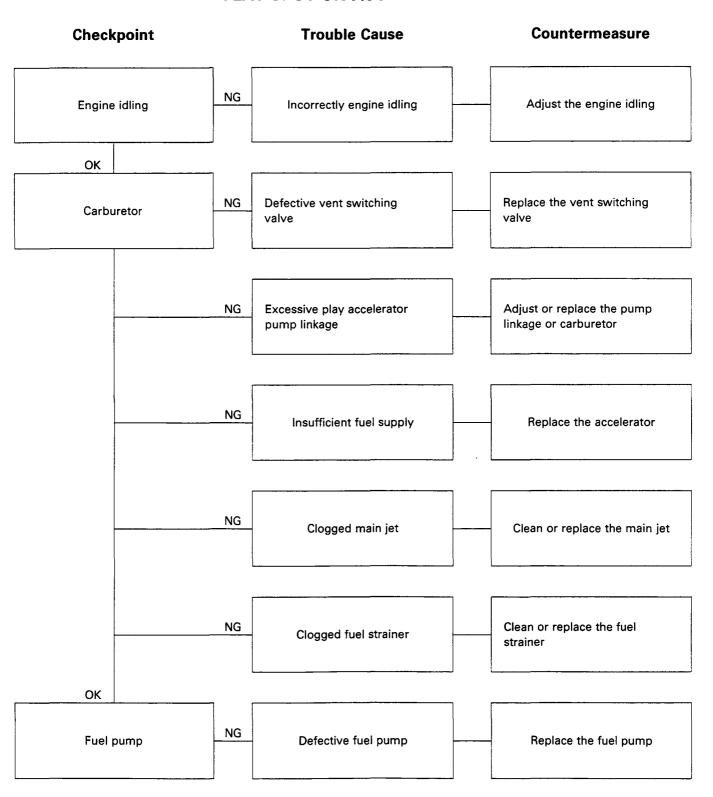


# **INSUFFICIENT POWER**

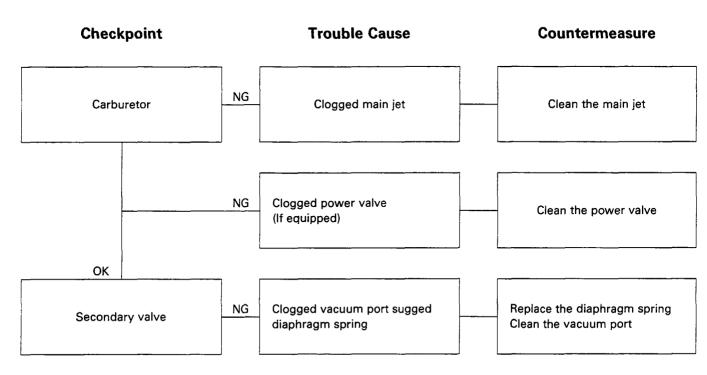




# **FLAT SPOT ON ACCELERATION**



# **FLAT SPOT ON HIGH SPEED OPERATION**













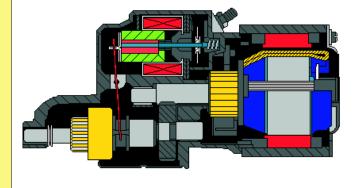


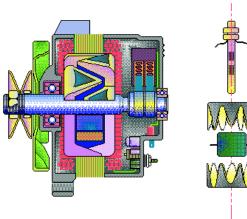
Specs.

Alternator

Starter

Distributor





# KB TF 140 Petrol **Engine Electrical**



# SECTION 6D ENGINE ELECTRICAL

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# MAIN DATA AND SPECIFICATIONS

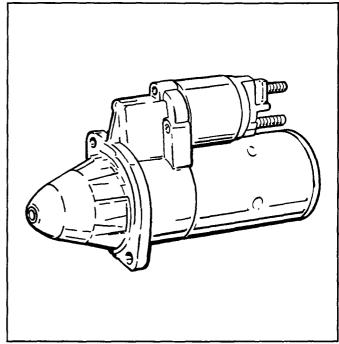
STARTER MOTOR Type Rated voltage Rated out-put Terminal voltage - with load	V	Magnet shift, Reduction type
Rated voltage Rated out-put	v	Magnet shift Reduction type
Rated out-put	v	Magnet Stiff, Heddellor type
•	v (	12
Terminal voltage - with load	kW	1.4 kW
	V	8
ALTERNATOR		
Type	V	Stator diode rectified
Voltage	V	12
Drive & rotation		V-belt, clockwise viewed from front
Ground polarity		Negative
Maximum out-put		
Amperameter	Α	55
REGULATOR		
Туре		IC regulator
DISTRIBUTOR		
Туре		Full Transistor type (Contact pointless)
Ignition interval		89° - 91°
Direction of rotation		Clockwise (as viewed from capside)
SPARK PLUG		
Model		BPR6ES or BPR6ES11
Size m	ım(in)	M14, P = 1.25 (0.049)
Spark gap m	nm(in)	
without catalytic converter vehicle		0.7 - 0.8 (0.028 - 0.031)
with catalytic converter vehicle		1.0 - 1.1 (0.040 - 0.043)

# **GENERAL DESCRIPTION**

#### **ALTERNATOR**



#### STARTER MOTOR



#### **ALTERNATOR**

The basic charging system is the IC integral regulator charging system.

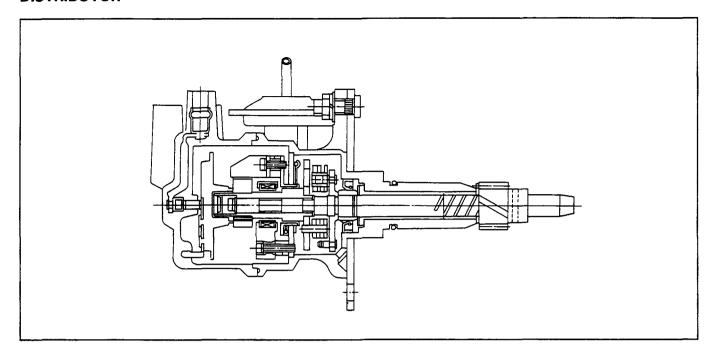
The generator features a solid state regulator that is mounted inside the generator. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The generator voltage setting cannot be adjusted.

#### **STARTER**

The starter motor circuit is composed of a 4-pole 4-brush type direct current series motor, ignition switch with safety lock, etc. The starter motor circuit utilizes negative ground polarity.

The starter engagement mechanism is of an integral type with the main switch fitted into the magnetic switch that controls shifting of the starter pinion. The pinion incorporates an overrunning clutch.

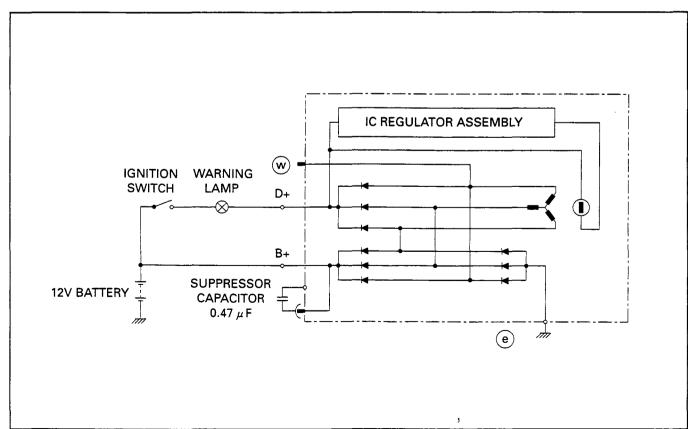
#### **DISTRIBUTOR**



The 4Z series engine uses a full transisterized type. (Contact pointless type).

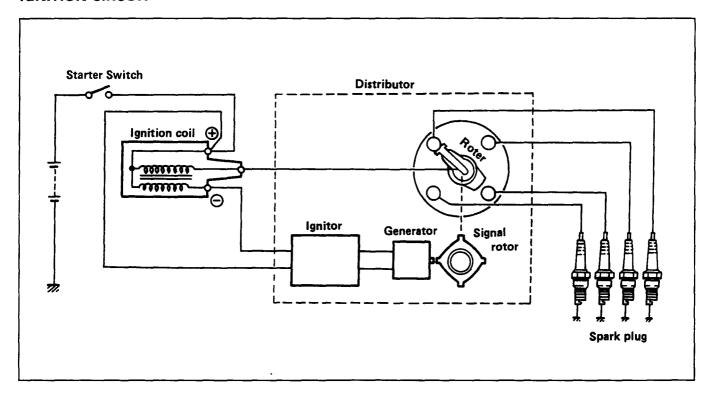
The distributor consists of the distributor shaft, the rotor shaft, the rotor head, the breaker assembly, the reluctor, the governor flyweight, the pinion gear, and the vacuum control.

#### **CHARGING CIRCUIT DIAGRAM**



D06LV00

#### **IGNITION CIRCUIT**

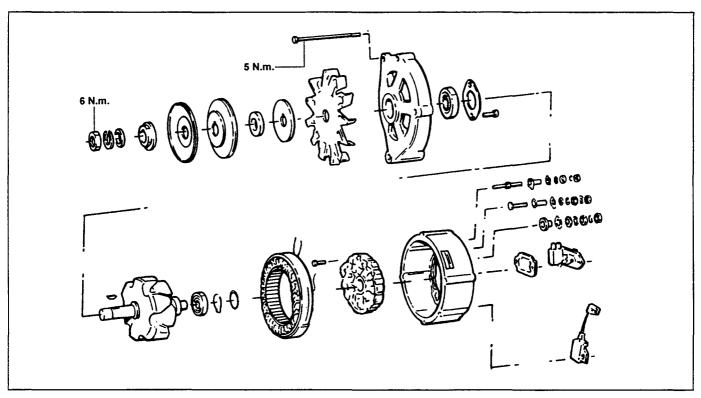




# **TORQUE SPECIFICATIONS**

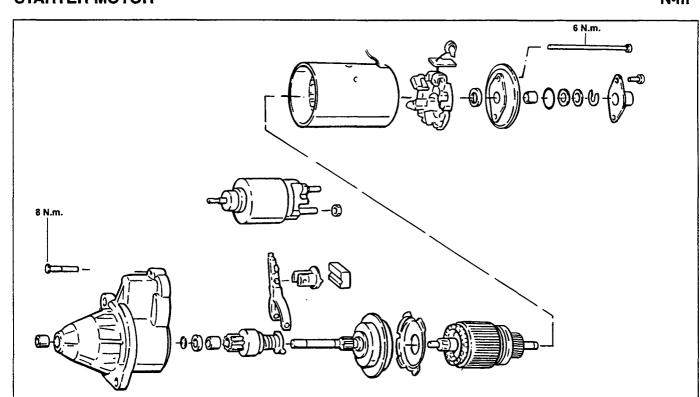
# **ALTERNATOR**

N·m



# STARTER MOTOR

N·m



# **ALTERNATOR**





٤

# **REMOVAL AND INSTALLATION**

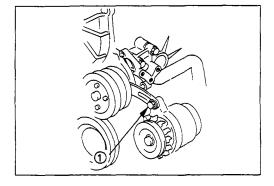
Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



### Important Operations — Removal

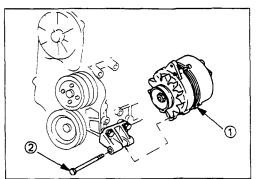
Use a circuit tester to inspect the charging circuit before removal.

Refer to "INSPECTION AND REPAIR" "CHARGING CIRCUIT ON THE VEHICLE".



#### **▲ Cooling Fan Belt**

- Loosen and remove the fan belt adjusting plate bolts
   ①.
- 2) Remove the fan belt from the alternator drive pulley.



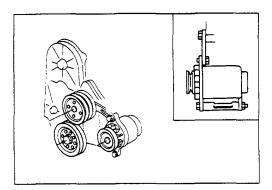
#### **▲** Alternator

Remove the alternator bolt ① and the alternator ② from the bracket.



## Important Operations - Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

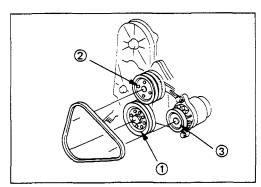




#### ▲ Alternator

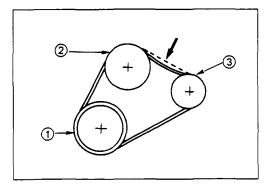
- 1. Install the alternator to the bracket.
- 2. Tighten the alternator bolt to the specified torque.

Alternator Bolt Torque	kg⋅m(lb.ft/N⋅m)
3.8 ± 1.0 (27.5 ±	$7.2/37.2 \pm 9.8$ )



#### **▲ Cooling Fan Belt**

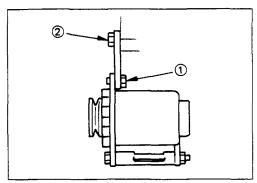
- 1) Hold the alternator toward the engine.
- 2) Install the fan belt to the three pulleys.
  - ① Crankshaft pulley
  - ② Water pump pulley
  - 3 Alternator pulley





- 3) Adjust the fan belt tension.
  - ① Use a bar to pull the alternator away from the engine as far as possible.
  - ② Use your hand to apply a pressure of 10 kg (22 lb/98 N) to the area of the fan belt indicated by the arrow in the illustration.

There should be from 8 - 12 mm (0.31 - 0.47 in) of belt deflection.

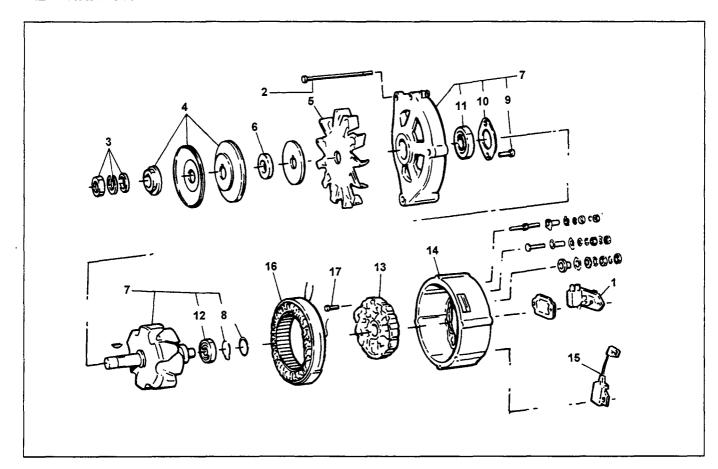




4) Tighten the adjusting plate bolts to the specified torque a little at a time in the numerical order shown in the illustration.

Adjusting Plate Bolt Torque kg·m(lb.ft/N·m)  $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

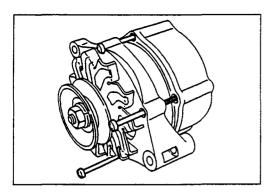
# **ALTERNATOR**





# **Disassembly Steps**

- 1. Blush and EE regulator
- 2. Through bolt
- 3. Pulley nut, cup and washer
- 4. Pulley
- 5. Fan
- 6. Spacer
- 7. Rotor assembly
- 8. Wave washers
- 9. Screw
- 10. Bearing retainer
- 11. Front bearing
- 12. Rear bearing
- 13. Front cover
- 14. Rear cover
- 15. Condenser
- 16. Stator
- 17. Battery terminal
- 18. Diode bridge





# **DISASSEMBLY**

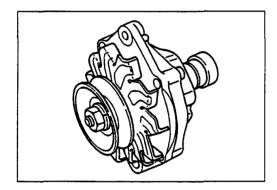
- 1. Blush and EE regulator
- 2. Through Bolt
  - Remove the through bolt.
  - Insert the tip of a pry bar into the gaps between the front cover and the stator core. Pry apart and separate the front cover and rotor and the rear cover and stator.

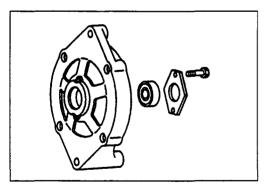


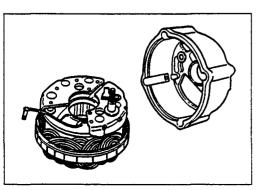
#### **CAUTION:**

Take care not to scratch or otherwise damage the stator coil with pry bar.

- 3. Pulley Nut Clip and Washer
- 4. Pulley
- 5. Fan
- 6. Spacer
- 7. Rotor Assembly
  - Remove the rotor assembly from front cover.
- 8. Wave Washers
- 9. Screw
- 10. Bearing Retainer
- 11. Front Bearing
- 12. Rear Bearing
- 13. Front Cover

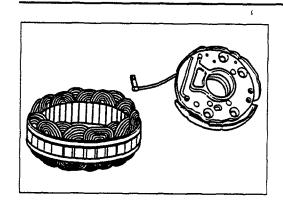






#### 14. Rear Cover

- Remove the three retaining screws and the BAT terminal
- Separate the rear cover from the stator.
- 17. Condenser

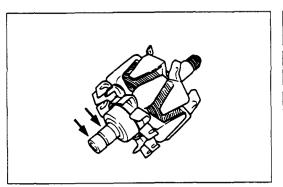


#### 16. Stator

- Cut the diode soldering points, then remove the stator.
- 17. Battery Terminal
- 18. Diode Bridge

# INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





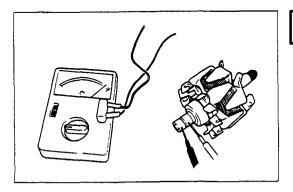
#### **ROTOR ASSEMBLY**

Inspection the slip ring faces for dirt and pitting.
 Wipe away any dirt with a clean cloth soaked in alcohol.

Use a hand grinder to remove pitting.

Measure the slip ring diameter.
 If the slip ring diameter is less than the specified limit, the slip rings must be replaced.

Slip Ring Diameter	mm(in)	
Standard	Limit	
27.0 (1.063)	26.0 (1.024)	



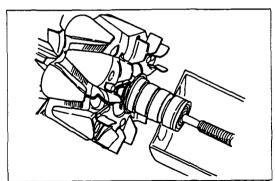


3. Measure the rotor coil resistance.

Rotor Coil Resistance at 20°C (68°F)

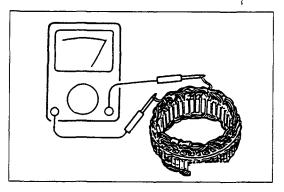
Standard

2.69



4. Check for continuity between the slip rings and the rotor core or shaft.

If there is continuity, the entire rotor assembly must be replaced.

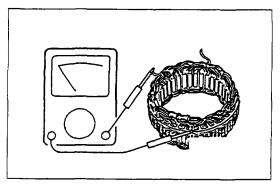




#### STATOR COIL ASSEMBLY

Check for continuity across the stator coils.
 If there is no continuity, the stator coils must be replaced.

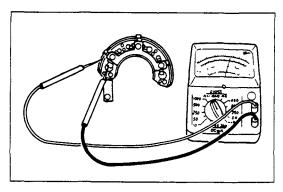
Resistance Between The Terminal "N" and	
The Coil Ends (Reference)	Ohms
Standard	
0.14	





2. Check for continuity between each stator coils and the stator core.

If there is continuity, the stator coils must be replaced.





#### DIODE

- Measure the resistance between each diode terminal and holder in forward and reverse directions with the connection of the tester leads switched. The diodes are normal if resistance is nearly zero ohms in one direction and is infinitely high in the other direction.
- If a diode has no resistance or equal resistance in both directions, it is defective and should be replaced together with the holder.



Brush

#### **BRUSH**

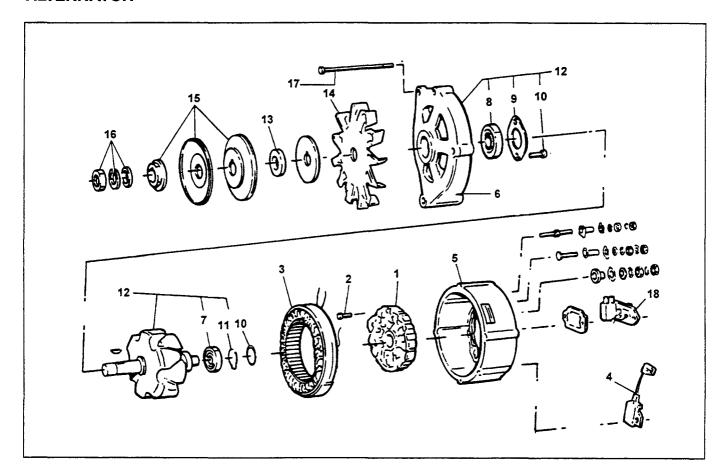
- 1. Measure the brush length.
- If the measured brush length is less than 5.5 mm, the brush and the brush holder assembly must be replaced.

There is a minimum brush length limit line stamped into the brush.

Length	_	mm(in)
	Limit	
	3.8 (0.150)	

- 3. Brush soldering precautions.
  - Be sure to use 60/40 resin cored solder.

#### **ALTERNATOR**



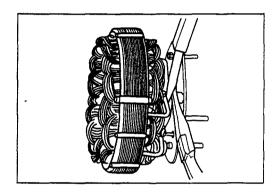


# **Reassembly Steps**

- ▲ 1. Diode bridge
  - 2. Battery terminal
- ▲ 3. Stator
  - 4. Condenser
  - 5. Rear cover
  - 6. Front cover
  - 7. Rear bearing
  - 8. Front bearing
  - 9. Bearing retainer
  - 10. Screw
  - 11. Wave washers
- ▲ 12. Rotor assembly
  - 13. Spacer
  - 14. Fan
  - 15. Pulley
  - 16. Pulley nut, clip and washer
  - 17. Through bolt
  - 18. Blush and EE regulator



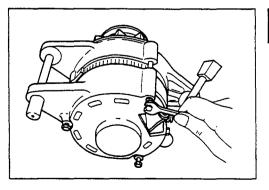
# **Important Operations**



#### 1. Diode Bridge

#### 3. Stator

- Solder together the rectifier and stator leads.
   Hold the diode lead near the rectifier with a pair of long-nose pliers to protect the rectifier from heat.
   Complete the soldering procedure as quickly as possible.
- 2) Install the rectifier/stator assemblies to the rear cover. Be absolutely sure that the washers and the insulators are reinstalled to their original positions. Hold the stator coil against the rear cover. Do not allow the stator coil to fall free.





# 12. Rotor Assembly with Rear Bearing

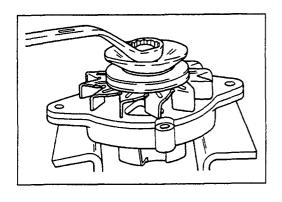
# 17. Through Bolt

- Install the front cover and rotor assembly to the rear cover.
  - Take care not to damage the rotor, the coil leads, and the coil seal lip, and the splines.
- 2) Place the guide bar to the rear cover bracket hole.
- Align the front cover bracket hole with the guide bar.
   Install the through bolt.
- 4) Tighten the through bolts to the specified torque.

Through	n Bol	t To	rque
---------	-------	------	------

N•m

#### **6D-16 ENGINE ELECTRICAL**





# 15. Pulley

#### 16. Pulley Nut and Washer

- 1) Carefully clamp the rotor in a vise.
- Install the pulley and the pulley nut.
- 3) Tighten the pulley to the specified torque.

Pulley Nut Torque		N•m
	6	

#### Note:

Take care not to damage the rotor when clamping it in the vise.

# STARTER MOTOR



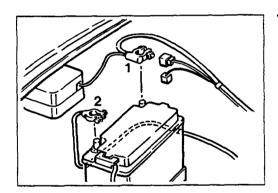


# **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



Important Operations - Removal





#### **▲** Starter Motor

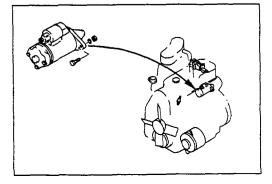
### Magnetic Switch Cable

- 1. Disconnect the battery cable (1) and the grounding cable (2) from the battery terminals.
- 2. Disconnect the magnetic switch cable from the terminal bolts.
- 3. Disconnect the battery cable at the starter motor and the ground cable at the cylinder body.
- 4. Remove the starter motor from the engine.



# Important Operations - Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





#### ▲ Starter Motor

- . Install the starter motor to the rear plate.
- 2. Tighten the starter motor bolts to the specified torque.

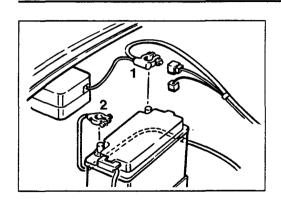
Starter Motor Bolt Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $8.8 \pm 1.9 (63.6 \pm 16.6/86.2 \pm 18.6)$ 

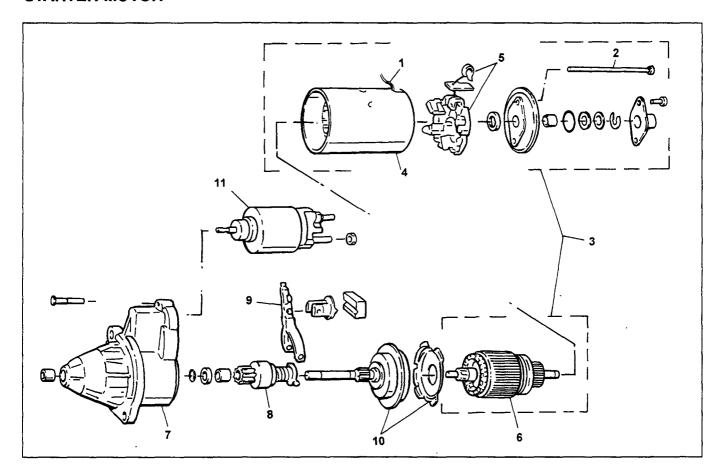
 Reconnect the battery cable at the starter motor and the grounding cable at the cylinder body.

#### **6D-18 ENGINE ELECTRICAL**



4. Reconnect the battery cable (1) and the grounding cable (2).

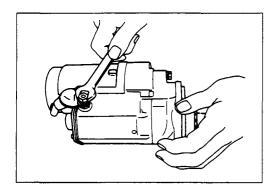
# STARTER MOTOR





# **Disassembly Steps**

- ▲ 1. Lead wire
  - 2. Through bolt
- ▲ 3. Yoke assembly
  - 4. Field coil
- ▲ 5. Brush and brush holder
- ▲ 6. Armature
- ▲ 7. Drive side housing
  - 8. Bendix drive
  - 9. Fork lever
  - 10. Planet gear set
  - 11. Solenoid

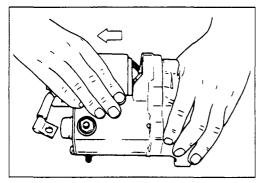


# V

# **Important Operations**

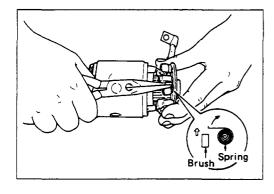
#### 1. Lead Wire

Disconnect the lead wire at the magnetic switch.



#### 3. Yoke Assembly

Pull the magnetic switch from the yoke.

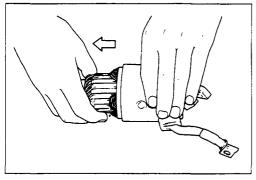


#### 5. Brush and Brush Holder

1) Use a pair of long-nose pliers to compress the spring end.

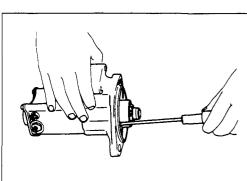
Remove the brushes from the yoke.

2) Remove the brush holder from the yoke.



#### 6. Armature

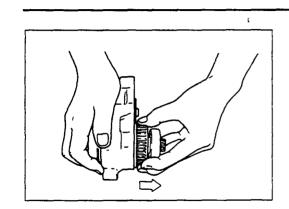
Tap on the yoke end with a soft mallet to remove the armature from the yoke.



#### 7. Drive Side Housing

- 1) Remove the two screws from the drive housing.
- 2) Pull the drive housing from the magnetic switch.

#### **ENGINE ELECTRICAL 6D-21**



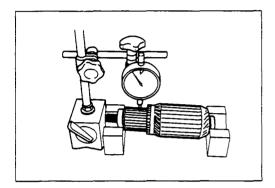
#### 8. Bendix Drive

Remove the Bendix Drive from the drive side housing.



# INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any other abnormal condition is found through inspection.



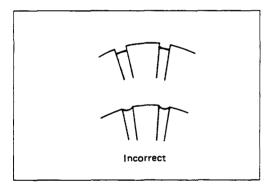


#### **ARMATURE**

1. Measure the commutator run-out.

Replace the commutator if the measured run-out exceeds the specified limit.

Commutator Run-out	mm(in)
Standard	Limit
0.02 (0.0008)	0.05 (0.0020)



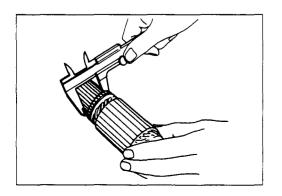


- 2. Check the commutator mica segments for excessive
- 3. Measure the mica segment depth.

Mica Segment Depth	mm(in)
Standard	Limit
0.5-0.8 (0.028-0.035)	0.2 (0.008)

If the mica segment depth is less than the standard but more than the limit, the commutator may be reground.

If the mica segment depth is less than the limit, the commutator must be replaced.

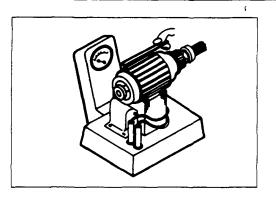




4. Measure the commutator outside diameter.

Commutator Outside Diamete	ermm(in)	
Standard	Limit	
35 (1.378)	34 (1.339)	

If the measured outside diameter is less than the specified limit, the commutator must be replaced.



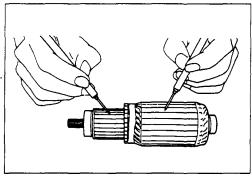


- 5. Test the armature for short circuiting.
  - 1) Place the armature in a growler tester.
  - 2) Hold a hacksaw blade against the armature core.

Slowly rotate the armature.

If the armature has a short circuit, the hacksaw blade will vibrate.

Replace the armature if there is a short circuit.

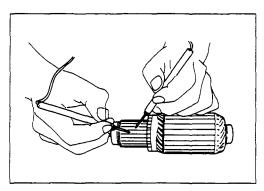




- 6. Use a circuit tester to check the armature for grounding.
  - 1) Hold one probe of the circuit tester against the commutator segment.
  - 2) Hold the other circuit tester probe against the armature core.

If the circuit tester indicates continuity, the armature is grounded.

The armature must be replaced.

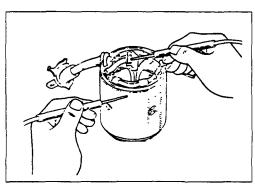




- 7. Use the circuit tester to check the armature for continuity.
  - 1) Hold the circuit tester probes against two armature core segments.
  - Repeat Step 1 at different segments of the armature core.

There should be continuity between all segments of the armature core.

If there is not, the armature must be replaced.





#### YOKE

- 1. Use a circuit tester to check the field winding ground.
  - 1) Hold one circuit tester probe against the field winding end or brush.
  - 2) Hold the other circuit tester probe against the bare surface of the yoke body.

There should be no continuity.

If there is continuity, the field coil is grounded.

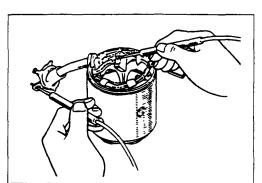
The yoke must be replaced.

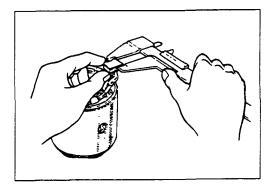


- 2. Use the circuit tester to check the field winding continuity.
  - Hold one circuit tester probe against the "C" terminal lead wire.
  - 2) Hold the other circuit tester probe against the field winding brush.

There should be continuity.

If there is no continuity, the yoke must be replaced.





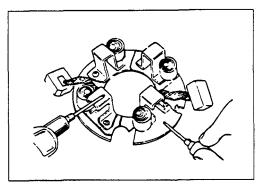


# **BRUSH AND BRUSH HOLDER**

1. Use a vernier caliper to measure the brush length (four brushes).

Replace the brushes as a set if one or more of the brush lengths is less than the specified limit.

Brush Length	mm(in)	
	Standard	Limit
Other	15.0 (0.590)	10.0 (0.394)





2. Use a circuit tester to check the brush holder insulation.

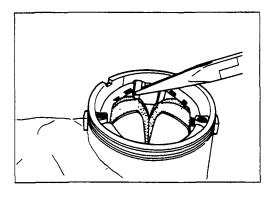
Touch one probe to the holder plate and the other probe to the positive brush holder.

There should be no continuity.

3. Inspect the brushes for excessive wear.

If the negative brushes have excessive wear, the entire brush holder assembly must be replaced.

If the positive brushes have excessive wear, only the brushes must be replaced.

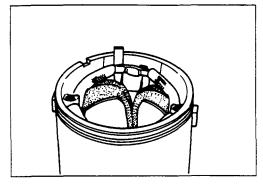




# **Brush Replacement**

### **Brush Removal**

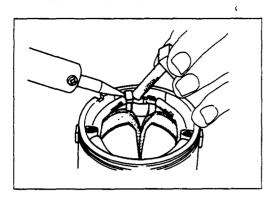
- 1. Use a pair of side cutters to cut the lead wire from the brush.
- File away any foreign matter clinging to the edge of the lead wire.
- 3. Remove the brushes from the brush holder.



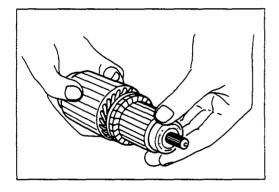


#### **Brush Installation**

- 1. Install the new brushes.
- 2. Straighten the bent portion of the clip.
- 3. File away any foreign matter clinging to the clip surface.



- 4. Place the lead wire in the clip.
- 5. Bend the clip shut.
- 6. Solder the brush lead.
- 7. Repeat the procedure for each of the brushes.



#### BEARING

Inspect the bearings for excessive wear and damage. Replace the bearings if necessary.

#### **MAGNET SWITCH**

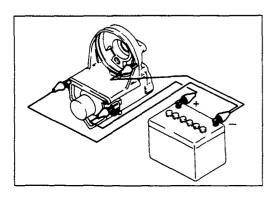
The following tests must be performed with the starter motor fully assembled.

The yoke lead wire must be disconnected from the "C" terminal.

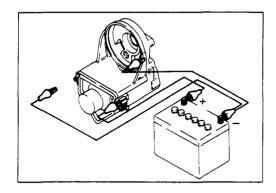
To prevent coil burning, complete each test as quickly as possible (within three to five seconds).

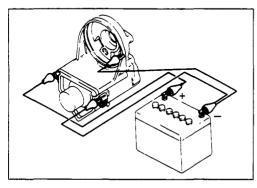


- 1. Connect the battery negative test leads to the starter motor body and the "C" terminal.
- Touch the battery positive test lead to the "50" terminal. If the magnetic switch function is satisfactory, there will be a strong magnetic force moving the pinion away from its home position.



#### **6D-26 ENGINE ELECTRICAL**





#### Hold-In Test

- 1. Connect the battery negative test lead to the starter motor body.
- Touch the battery positive test lead to the "50" terminal.

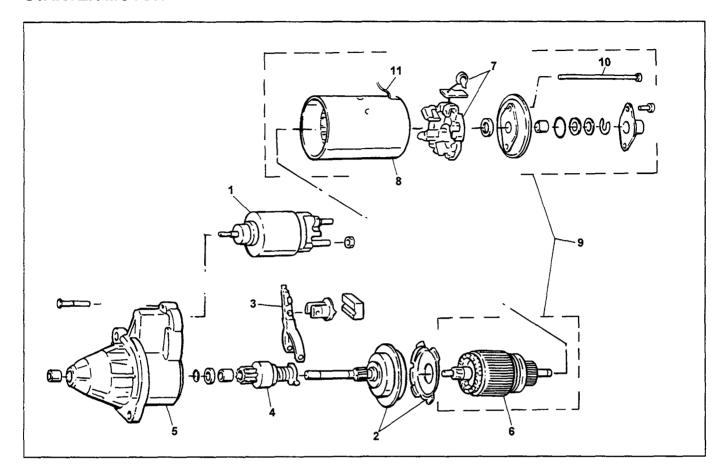
If the magnetic switch function is satisfactory, there will be a strong magnetic force moving the pinion away from its home position.

#### Return Test

- 1. Connect the battery negative test lead to the starter motor body and the "50" terminal.
- Touch the battery positive test lead to the "C" terminal.

If the magnetic switch function is satisfactory, there will be a strong magnetic force moving the pinion toward its home position.

#### STARTER MOTOR



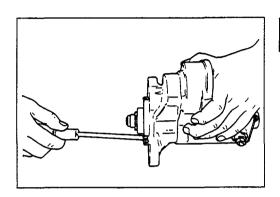


# **Reassembly Steps**

- 1. Solenoid
- 2. Planet gear set
- 3. Fork lever
- 4. Bendix drive
- ▲ 5. Drive side housing
- ▲ 6. Armature
- ▲ 7. Brush and brush holder
  - 8. Field coil
- ▲ 9. Yoke assembly
- ▲ 10. Through bolt
  - 11. Lead wire



# **Important Operations**

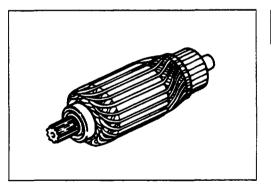




#### 5. Drive Side Housing

Tighten the drive housing screws to the specified torque.

•	J	•	
Drive Housing	Screw Torque		N•m



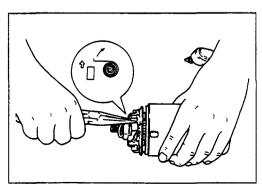


#### 6. Armature

Apply grease to the armature shaft bearings.

Do not allow the grease to touch the armature.

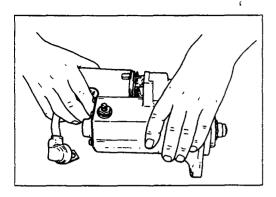
Grease on the armature will result in power loss and damage.



#### 7. Bush and Brush Holder

Install the brushes and the brush holder to the yoke and the armature.

Keep the brushes free of grease and other foreign material.

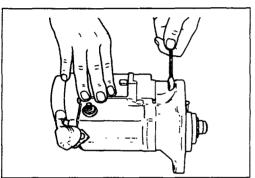


#### 9. YOKE ASSEMBLY

Install the yoke assembly to the magnetic switch.

Be sure to use a new O-ring.

Do not attempt to reuse the old O-ring.

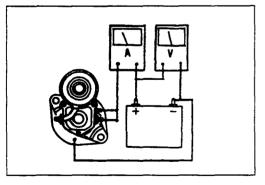




#### 10. Through Bolt

Tighten the through bolts to the specified torque.

Drive Housing Screw Torque	N•m_
6.0	





#### **Operating Test**

Perform the operating test after assembly of the starter motor.

- Clamp the assembled starter motor securely in a vise.
- 2. Connect a standard 12-volt battery, a voltmeter, and an ammeter to the starter motor.
- Apply battery voltage to the starter motor.
   Pinion position should change immediately.
   The starter motor should operate smoothly.

#### **Test Conditions**

Applied Voltage	(V)	11.5
Amperage	(A)	Less than 90
Starter Motor Operat		
Speed	_ (rpm)	More than 3,000

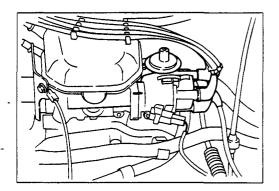
# **DISTRIBUTOR**





# **REMOVAL AND INSTALLATION**

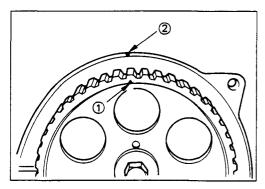
Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.





# **Important Operations**

Mark the distributor flange and cylinder head side. then remove the distributor.



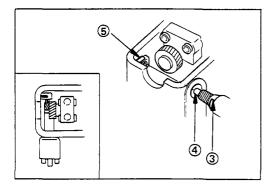


#### ▲ Distributor

1) Move the No. 4 cylinder to TDC on the compression stroke.



Align the camshaft pulley setting mark ① with the front plate setting mark ②.





2) Apply engine oil to the O-rings.



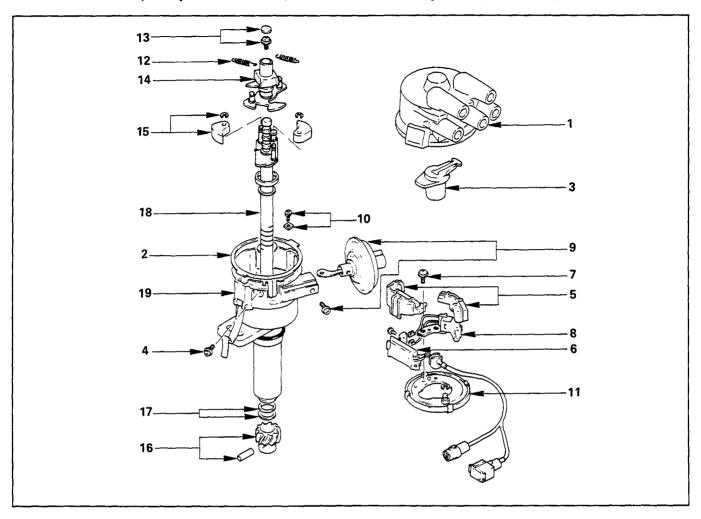
- 3) Align the distributor case setting mark ③ with the distributor shaft setting mark ④.
- 4) Install the distributor to the cylinder head.
  - Align the distributor shaft setting mark with the cylinder head setting mark ⑤.
- 5) Tighten the distributor bolts to the specified torque.

Distributor Bolt Torque

kg⋅m(lb.ft/N⋅m)

 $1.9 \pm 0.5 (13.7 \pm 3.6/18.6 \pm 4.9)$ 

(Except Switzerland, Sweden & Germany, Chili (From '92))

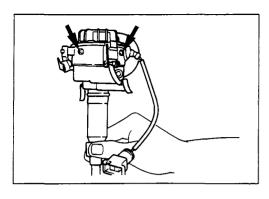


# **Disassembly Steps**

- 1. Distributor cap
- 2. Gasket
- 3. Rotor
- ▲ 4. Ignitor screw
  - 5. Dust proof cover
  - 6. Ignitor
- ▲ 7. Signal generator screw
  - 8. Signal generator
- ▲ 9. Vacuum advancer
  - 10. Breaker plate screw
  - 11. Breaker plate
  - 12. Flyweight spring
  - 13. Pad and screw
  - 14. Signal roter shaft
  - 15. Flyweight and clip
- ▲ 16. Gear and pin
  - 17. Washer
  - 18. Shaft19. Housing
  - i. vvasne

# Reassembly

To install the distributor, follow the removal procedure in reverse order.

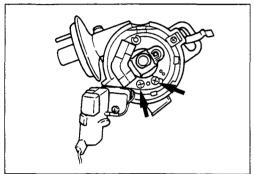




# **Important Operations**

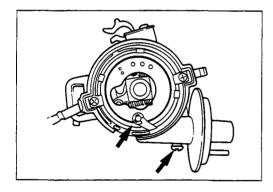
#### 4. Ignitor screw

Remove the ignitor screws from housing.



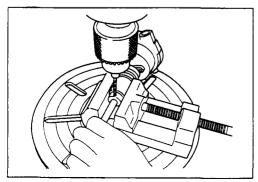
# 7. Signal generator screw

Remove the signal generator from breaker plate.



#### 9. Vacuum advancer

Remove the circlip fixing the vacuum advancer rod and remove the vacuum advancer.



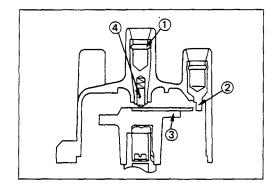
## 16. Gear and pin

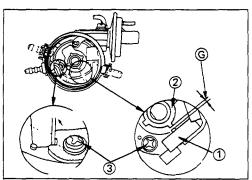
Break away caulking on the gear and remove the pin.

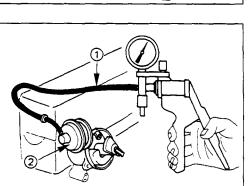


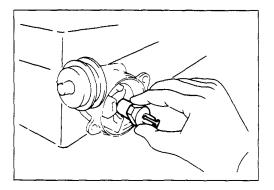
# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.









#### Distributor

Distributor Cap

Remove the distributor cap and check the following:

- 1) Check the center electrode ① and the side electrode ② for burning and corrosion.
- 2) Check the rotor 3 for excessive wear and burning.
- 3) Check the center carbon (4) for excessive wear and cracking.

Replace the parts as required.



2. Air Gap

Use a feeler gauge to measure the clearance between the signal generator ① and the distributor cam ②.

If the measured value is outside the specified value, adjust the air gap by loosening the two screws 3 and moving the bracket.

Air Gap

mm(in)

0.2 - 0.4 (0.008 - 0.016)



#### Vacuum Advancer

- 1. Remove the distributor cap and the igniter cover.
- 2. Disconnect the high tension cable from the distributor side terminal.
- 3. Move the high tension cable end to the coil fixing screw and keep the clearance about 5 mm.

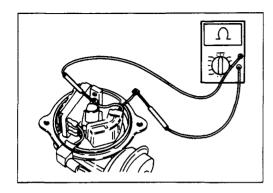


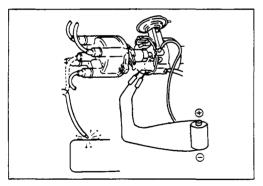
#### Governor

- 1. Check the rotor shaft for excessive looseness.
  - If the shaft is excessively loose, the governor is defective and must be replaced.
- 2. Turn the rotor shaft clockwise 1/4 of a turn and release it.

The rotor shaft should spring back.

If the shaft does not spring back, the governor is defective and must be replaced.







#### INSPECTION ON THE VEHICLE

#### **Signal Generator**

- Set the key switch to "OFF" position.
- Remove the distributor cap.
- Measure resistance across the signal generator terminals between red and white.

Standard resistance	140 — 180

#### Ignitor

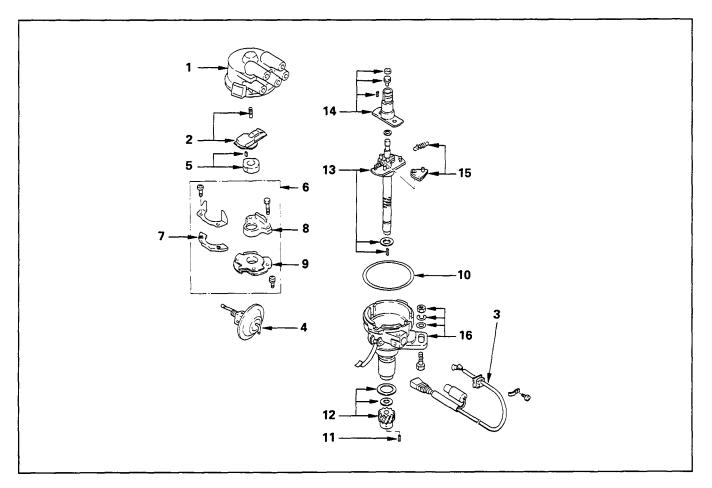
- 1. Remove the distributor cap.
- 2. Disconnect the ignition coil high-tension cable at the distributor side, and maintain a 5 to 6 mm gap between the cable end and the ground.
- 3. Connect a 1.5-volt dry cell battery to the red terminal ignitor at its (+) side and to the white terminal of ignitor at its (-) side.
- 4. Turn the key switch to the "ON" position.
- The ignitor is considered normal when spark are generated between the high-tension cable and the ground when one connected is disconnected.



Do not apply voltage to the ignitor for more than 3 seconds.

# DISASSEMBLY (For 4ZD1)

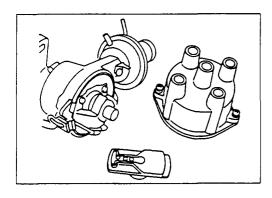
# (For Switzerland, Sweden, Germany and Chili (From '92))



# **Disassembly Steps**

- ▲ 1. Distributor cap
  - 2. Distributor rotor
  - 3. Distributor lead wire
- ▲ 4. Vacuum control
- ▲ 5. Retractor
  - 6. Breaker plate, magnet and unit
  - 7. Distributor magnet
  - 8. Distributor unit

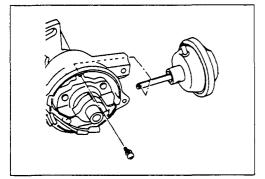
- 9. Breaker plate
- 10. Housing gasket
- ▲ 11. Roll pin
- ▲ 12. Pinion gear and gasket
  - 13. Distributor shaft
  - 14. Rotor shaft
- ▲ 15. Governor flyweight and spring
  - 16. Distributor housing





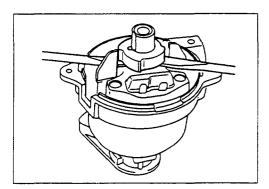
# **Important Operations**

- 1. Distributor Cap
- 1. Remove the distributor cap fixing screw.
- 2. Remove the distributor cap and the rotor.
- 3. Pull the carbon points from the distributor cap.



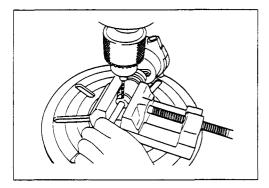
#### 4. Vacuum Control

Remove the ground terminal and vacuum control mounting screw.



#### 5. Retractor

- 1. Pry loose the retractor outer cover.
- 2. Insert a screwdriver into the lower side of the retractor.
- 3. Pull the retractor free.

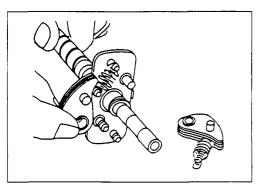


#### 11. Roll Pin

#### 12. Pinion Gear and Gasket

Break away the staking on the gear set and remove the pin.

File off staked end of the roll pin, then drive out the roll pin toward the opposite side.



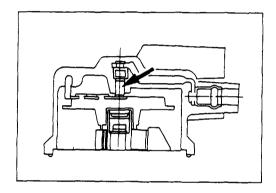
#### 15. Governor Flyweight and Spring

Remove the governor weight and the springs from the shaft.



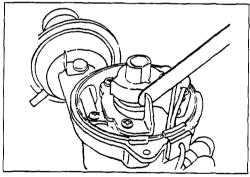
# **INSPECTION AND REPAIR**

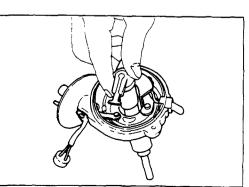
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



### **Distributor Cap**

Check the distributor cap and rotor for cracks and carbon tracks. Check the distributor cap center contact for wear. Center contact should be 2.2 mm (0.087 in) or longer.







### Air Gap

Using a feeler gauge, measure the air gap between the pick-up coil projections.



Air Gap

mm(in)

0.3 - 0.5 (0.012 - 0.020)

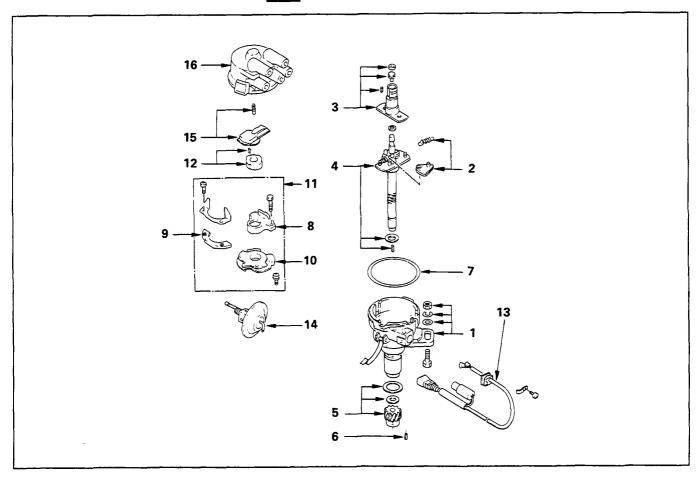
Adjust air gap if necessary.

Loosen the two screws and move the ignitor until the gap is correct. Tighten the two screws and check the air gap.

#### **Governor Control**

Turn the rotor shaft counter-clockwise, release it, and check that the rotor returns slightly clockwise.

# REASSEMBLY



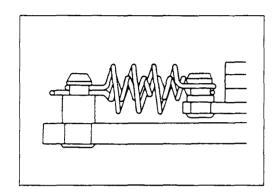
# **Reassembly Steps**

- 1. Distributor housing
- ▲ 2. Governor flyweight and spring
- ▲ 3. Rotor shaft
  - 4. Distributor shaft
- ▲ 5. Pinion gear and gasket
- ▲ 6. Roll pin
  - 7. Housing gasket
  - 8. Distributor unit

- 9. Distributor magnet
- Breaker plate
- ▲ 11. Breaker plate, magnet, and unit
- ▲ 12. Retractor
  - 13. Distributor lead wire
- ▲ 14. Vacuum control
  - 15. Distributor rotor
  - 16. Distributor cap

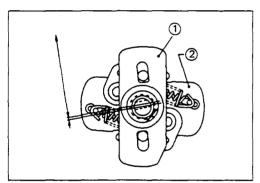


# **Important Operations**



#### 2. Governor Flyweight and Spring

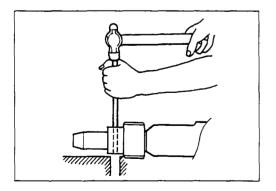
Attach the governor spring to the shaft spring hanger pin. The smaller tapered ends of the spring (both ends) should be secured to the lower side of the hook.





#### 3. Rotor Shaft

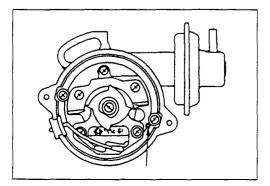
Carefully align the rotor shaft ① notches and the distributor shaft ② notches when installing the rotor shaft.



#### 5. Pinion Gear and Gasket

#### 6. Roll Pin

- 1. Carefully align the pinion gear pin hole and distributor shaft pin hole.
- 2. Set the pinion gear with gasket to the distributor shaft.
- 3. Insert the roll pin into the pin hole.
- 4. Caulk the roll pin both side.

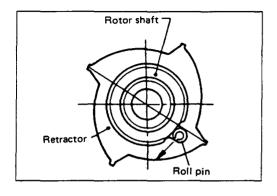




#### 11. Breaker Plate, Magnet, and Unit

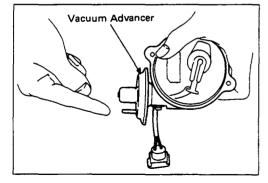
Carefully align the scribe marks on the breaker plate and the housing.

#### **6D-40 ENGINE ELECTRICAL**





The roll pin notch and the retractor notch must be parallel when the roll pin is inserted into the retractor.



#### 14. Vacuum Control

Apply vacuum and check that the vacuum advancer moves.

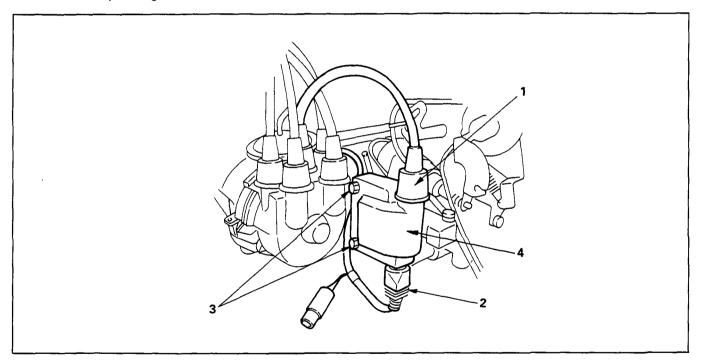
# **IGNITION COIL**





# **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



#### **Removal Steps**

- 1. High-tension cable
- 2. Lead (positive and negative terminals)
- 3. Attaching bolt
- 4. Ignition coil

# Installation Steps

To install, follow the removal procedure in the reverse order.

# **TROUBLESHOOTING**

Refer to this Section to quickly troubleshoot and repair engine electrical problems. Each troubleshooting chart has three headings arranged from left to right.

(1) Checkpoint (2) Trouble Cause (3) Countermeasure

This Section is divided into five sub-sections:

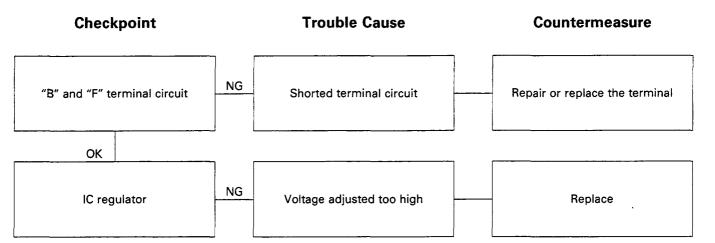
- 1. Charging and Noise Problem
  - 1) Noise charging takes place.
  - 2) Battery overcharging
  - 3) Battery undercharging
  - 4) Charging current unstable
  - 5) Noise
- 2. Starter Switch and Starter Motor Faulty
  - 1) Solenoid switch does not work when starter switch is turned on.
  - 2) Pinion engages ring gear properly, but engine will not turn over.
  - 3) Pinion gear does not properly engage ring gear.
  - 4) Starter motor does not stop when starter switch is turned off.
  - 5) Excessive sparking at commutator
- 3. Ignition Faulty
  - 1) No spark occurs.
  - 2) Spark occurs irregularly or jump across gap of only 1 to 2 mm (0.04 to 0.08 in).
  - 3) Spark jumps across gap of 5 mm (0.2 in) or more.
- 4. Rough Engine Running
  - 1) Engine misfires regularly.
  - 2) Engine knocks regularly.
  - 3) Engine lacks power.

#### 1. CHARGING AND NOISE PROBLEM

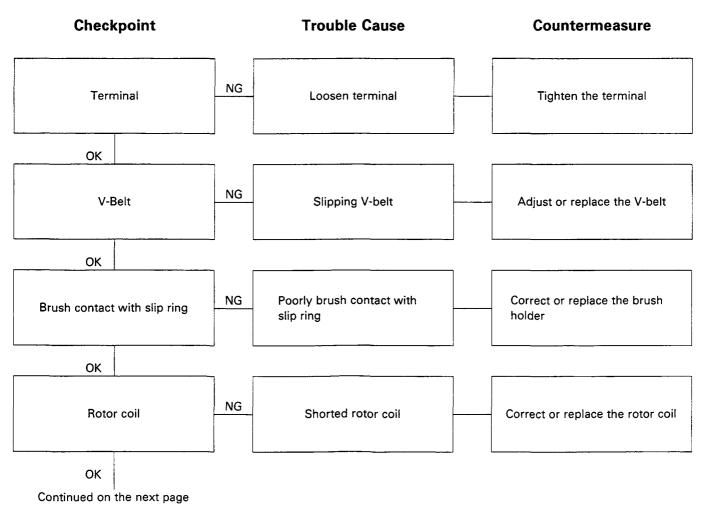
#### 1) NO CHARGING TAKES PLACE

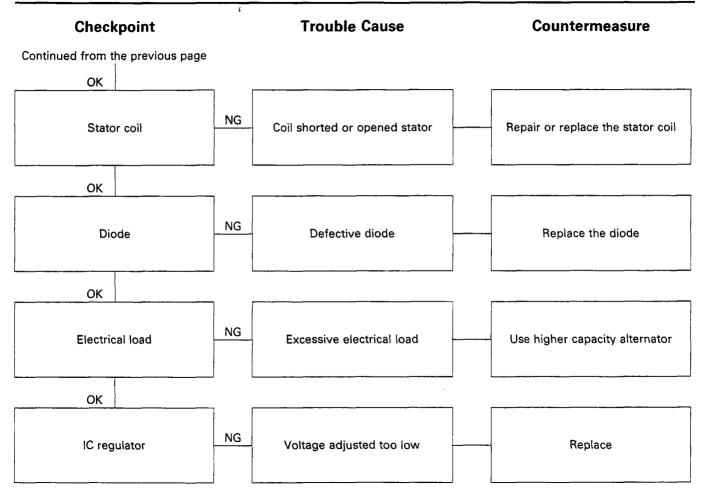
Checkpoint		Trouble Cause	Countermeasure
Terminal and connector	NG	Broken or defective terminal and/or connector	Repair the terminal and/ or connector
ОК	→ r		
Part ground condition	NG	Poorly grounded	Repair the grounded
ОК			
Brush contact with slip ring	NG	Poorly brush contact with slip ring	Repair or replace the brush contact with slip ring
ОК	_ r		
Stator coil	NG	Opened or burned stator coil	Repair or replace the stator coil
ОК	_		
Rotor coil	NG	Opened or burned rotor coil	Repair or replace the rotor coil
ОК	_		
Diode	NG	Defective diode	Replace the diode
ОК			
IC regulator	NG	Defective	Replace

#### 2) BATTERY OVERCHARGING

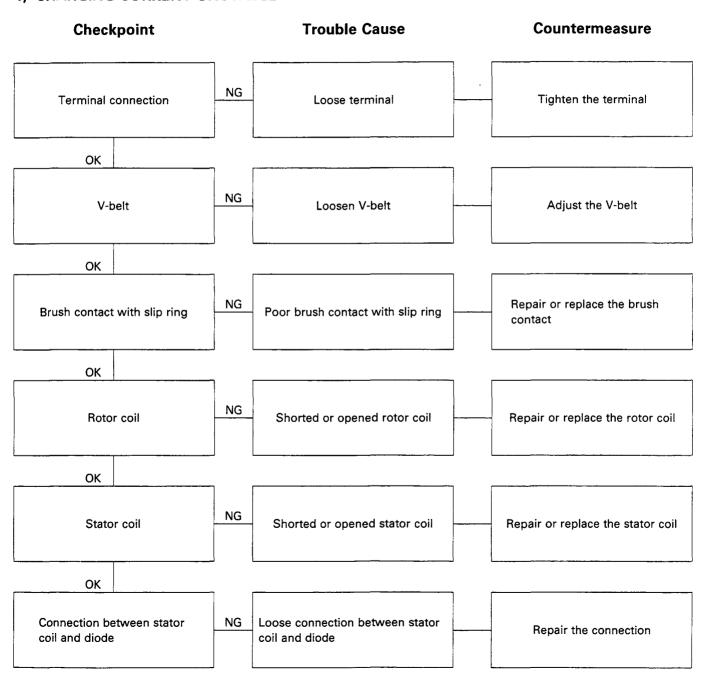


#### 3) BATTERY UNDERCHARGING

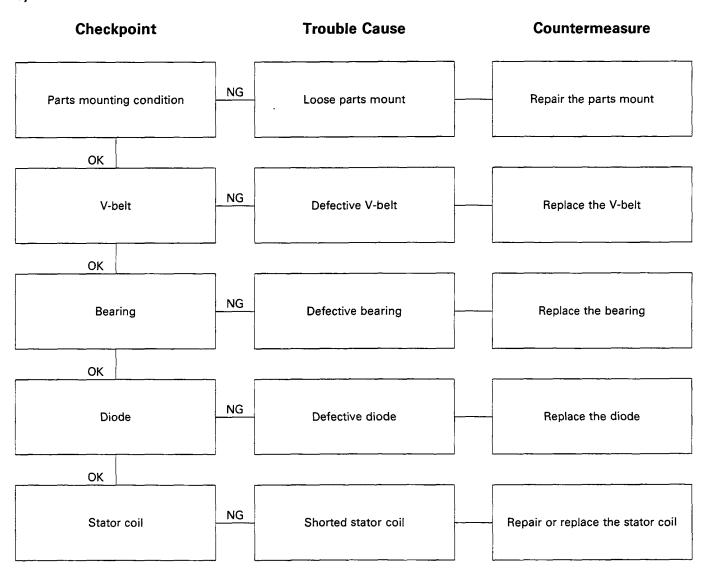




#### 4) CHARGING CURRENT UNSTABLE



#### 5) NOISE

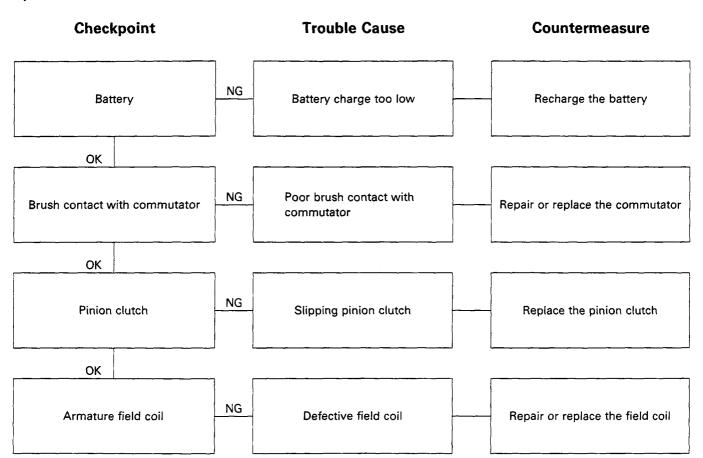


#### 2. STARTER SWITCH AND STARTER MOTOR FAULTY

#### 1) SOLENOID SWITCH DOES NOT WORK WHEN STARTER SWITCH IS TURNED ON

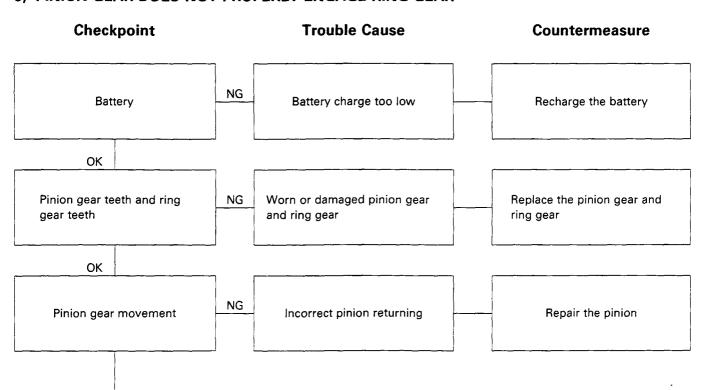
Checkpoint			Trouble Cause	Countermeasure
Bat	Battery		Battery charge too low	Recharge the battery
ОК		- -		
Starter	circuit	NG	Opened circuit, poorly connected, or incorrectly wired	Repair or replace the circuit, connector, or wire
ОК		<u> </u>		
Starter	switch	NG	Defective starter switch contact point	Replace the starter switch
ОК				
Magnetic :	switch coil	NG	Opened or burned magnetic switch coil	Replace the magnetic switch
ОК		- -		
Plunge	er shaft	NG	Bent or binding plunger shaft	Repair or replace the plunger shaft

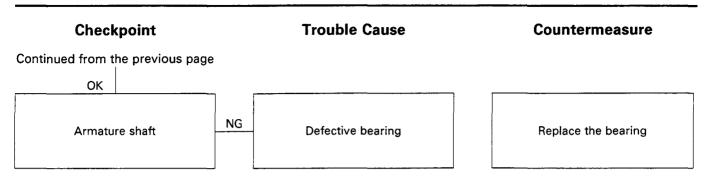
#### 2) PINION ENGAGES RING GEAR PROPERLY BUT ENGINE WILL NOT TURN OVER



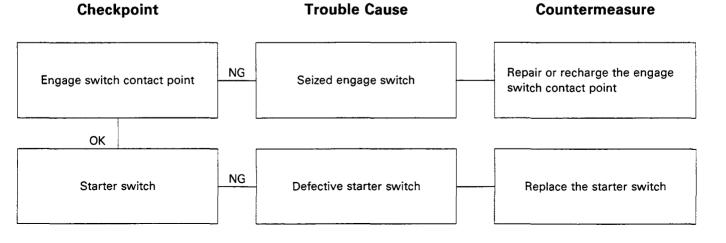
#### 3) PINION GEAR DOES NOT PROPERLY ENGAGE RING GEAR

Continued on the next page





#### 4) STARTER MOTOR DOES NOT STOP WHEN STARTER SWITCH IS TURNED OFF

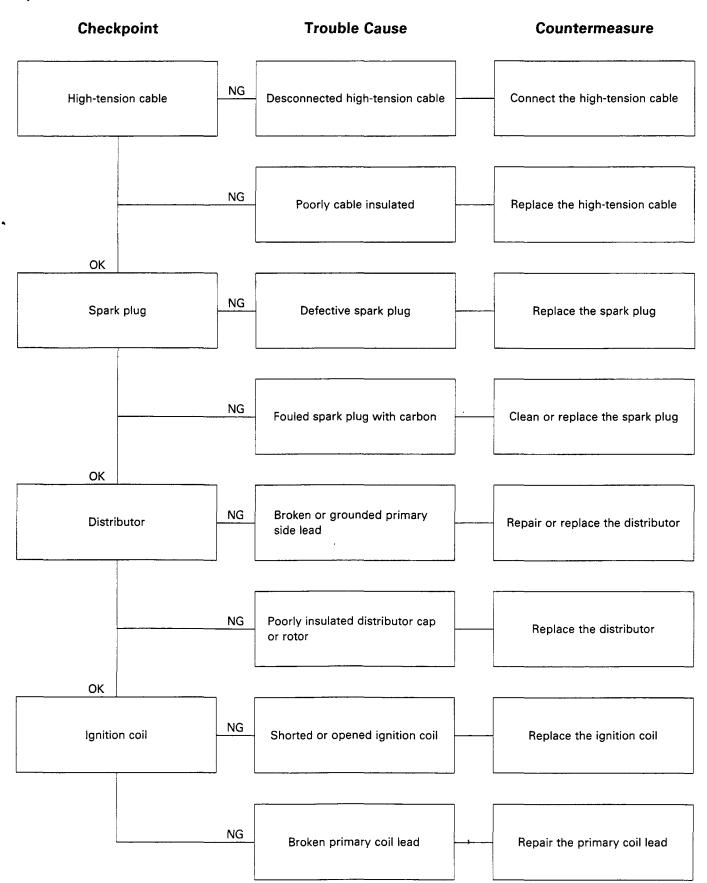


#### 5) EXCESSIVE SPARKING AT COMMUTATOR

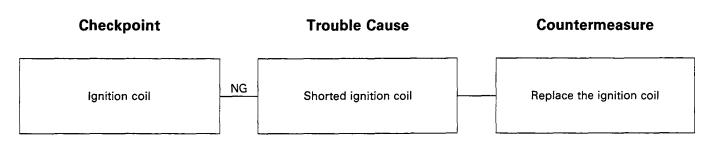
Checkpoint			Trouble Cause	Countermeasure
Brush contact with commutator		NG	Poor brush contact with commutator	Repair or replace the commutator
ОК		_		
Comm	nutator	NG	Commutator segment or under- cut phenol resin protected	Correct or replace the commutator
<u></u>		٢		
			Loose commutator	Repair or replace the commutator
OK				
Armatu	re shaft	NG	Run-out due to uneven wear in bearing	Replace the armature or bearing
OK		- '		
Brush	holder	NG	Loose mount	Repair the mount

#### 3. IGNITION FAULTY

#### 1) NO SPARK OCCURS



### 2) SPARK OCCURS IRREGULARLY OR JUMPS ACROSS GAP OF ONLY 1 to 2 mm (0.04 to 0.08 in)

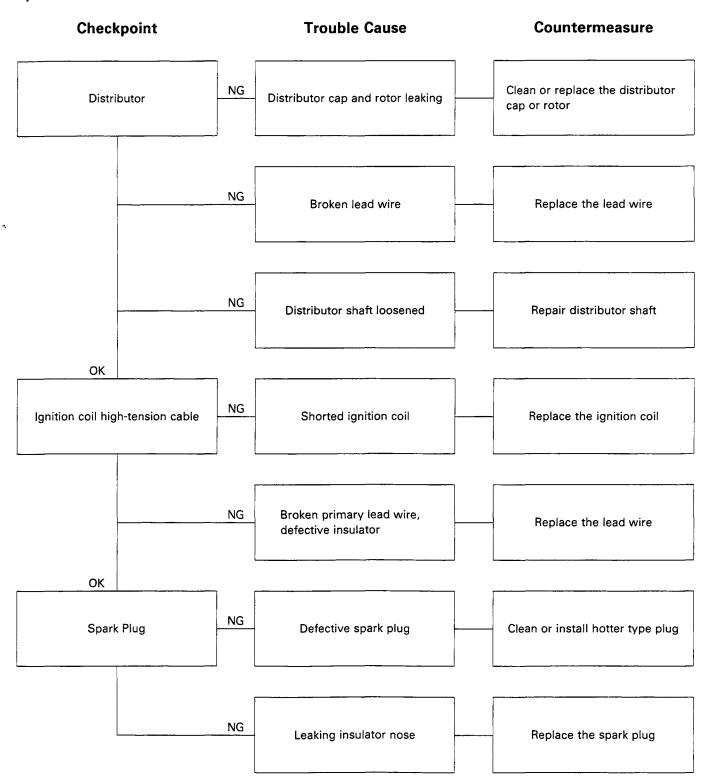


#### 3) SPARK JUMPS ACROSS GAP OF 5 mm (0.2 in) OR MORE

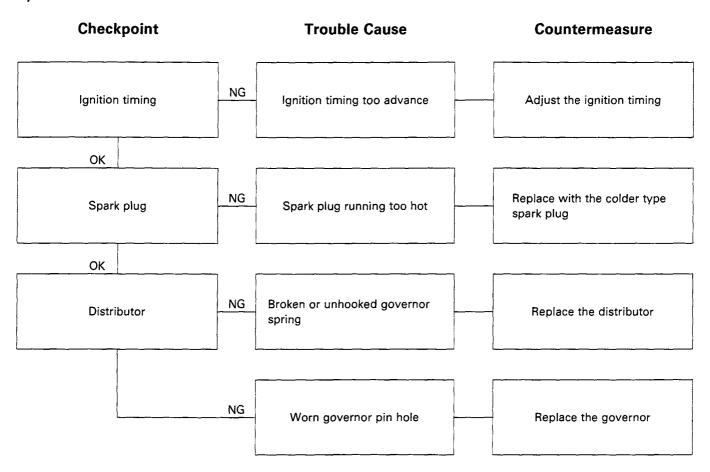
Checkpoint		Trouble Cause	Countermeasure
Spark plug	NG	Excessive spark plug gap	Adjust or replace the spark plug
	NG	Fouled spark plug with carbon	Clean or replace the hotter type spark plug
	NG	Broken porcelain insulator	Replace the spark plug
	NG	Worn out spark plug electrode	Replace the spark plug

#### 4. ROUGH ENGINE RUNNING

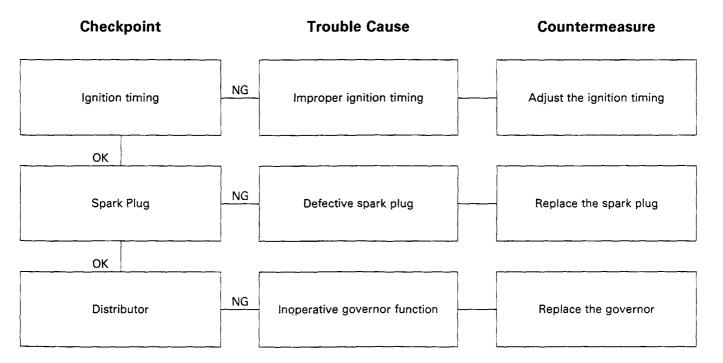
#### 1) ENGINE MISFIRES REGULARLY



#### 2) ENGINE KNOCKS REGULARLY



#### 3) ENGINE LACKS POWER









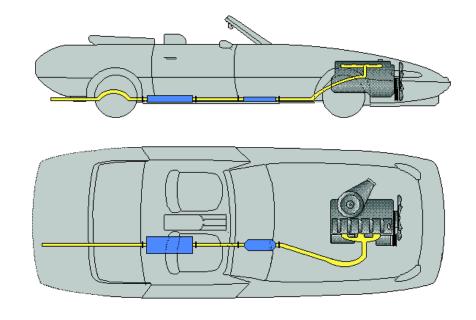




Specs.

Removal

Inspection



# KB TF 140 Petrol Engine Exhaust



**PAGE** 

## SECTION 6F ENGINE EXHAUST

#### **TABLE OF CONTENTS**

Main Data and Specifications	6F-2
General Description	6F-2
Removal and Installation	6F-3
Inspection and Repair	6F-4

#### MAIN DATA AND SPECIFICATIONS

Exhaust system

Pipe outside diameter × thickness

Front pipe mm(in)

Middle pipe mm(in)

Rear pipe mm(in)

Silencer

Type

Inside diameter mm(in)

Length mm(in)

Mounting

Number of suspension points

Type

Catalytic converter type

(For Switzerland and Sweden)

 $50.8 \times 1.5 (2.0 \times 0.059)$ 

 $50.8 \times 1.5 \ (2.0 \times 0.059)$ 

 $50.8 \times 1.6 \ (2.0 \times 0.063)$ 

Circular section-shell construction of triple skin and end plates, internal construction of baffles and perforated tubes.

Approximately 180 (7.09)

Approximately 525 (20.67)

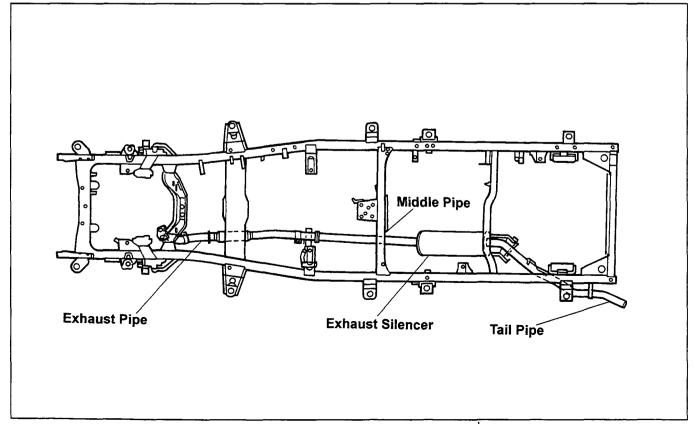
\_

Rubber and metal

Oxidizing catalytic (Until '90 model)

Three-way catalytic (From '91 model)

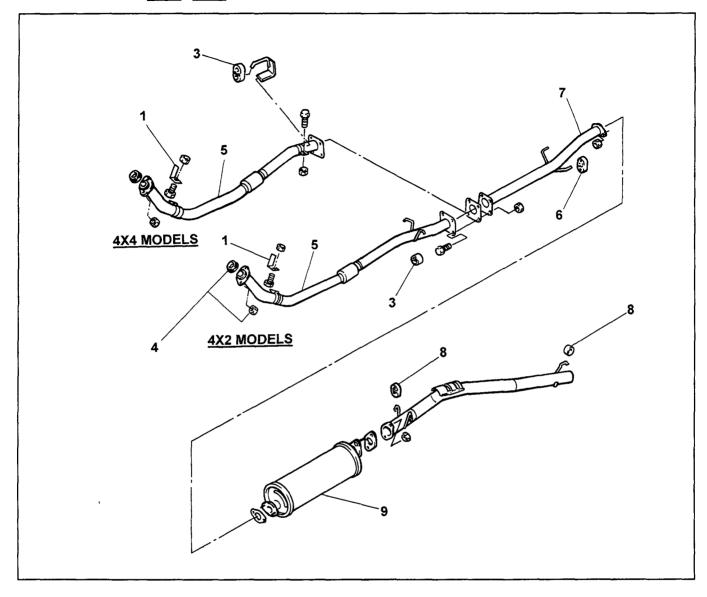
#### **GENERAL DESCRIPTION**



### **++**



#### **REMOVAL AND INSTALLATION**



#### **Removal Steps**

- 1. Front exhaust pipe bracket nut (Transmission side)
- 2. Front exhaust pipe mounting bracket nut (4x4 model)
- 3. Front exhaust pipe damper ring
- 4. Front exhaust pipe flange nut with gasket
- 5. Front exhaust pipe
- 6. Center exhaust pipe damper ring
- 7. Center exhaust pipe
- 8. Rear exhaust pipe damper rings
- 9. Exhaust silencer with rear exhaust pipe

#### Installation Steps

- 9. Exhaust silencer with rear exhaust pipe
- 8. Rear exhaust pipe damper rings
- 7. Center exhaust pipe
- 6. Center exhaust pipe damper ring
- 5. Front exhaust pipe
- 4. Front exhaust pipe flange nut with gasket
  - 3. Front exhaust pipe damper ring
  - 2. Front exhaust pipe mounting bracket nut (4x4 model)
  - 1. Front exhaust pipe bracket nut (Transmission side)



#### Important - Installation

#### 9. Exhaust Silencer with Rear Exhaust Pipe

Apply muffler sealer to the joining portion of the pipes.

#### 4. Front Exhaust Pipe Flange Nut

Connect the exhaust pipe to the exhaust manifold.

Front exhaust pipe to manifold nut.

Torque kg·m(lb.ft/N·m)  $6.8 \pm 0.5 (49 \pm 3.6/66 \pm 5)$ 



#### **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

#### Front Exhaust Pipe

Center Exhaust Pipe and Catalytic Converter Flange Nut

**Exhaust Pipe Damper Ring** 

**Exhaust Silencer with Rear Exhaust Pipe** 

Check the pipes for corrosion, cracking, damage or misalignment and repair if required.

Check the rubber rings for deterioration or damage and repair if required.





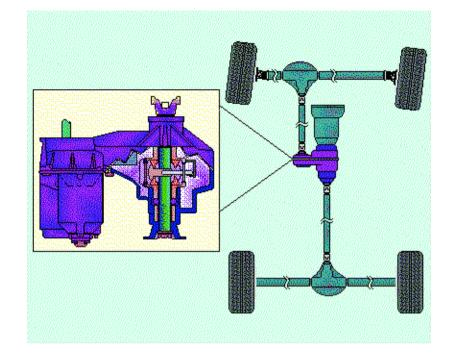






4 x 2

4 x 4



# KB TF 140 MSG Gearbox

## SECTION 7B MANUAL TRANSMISSION

#### **TABLE OF CONTENTS**

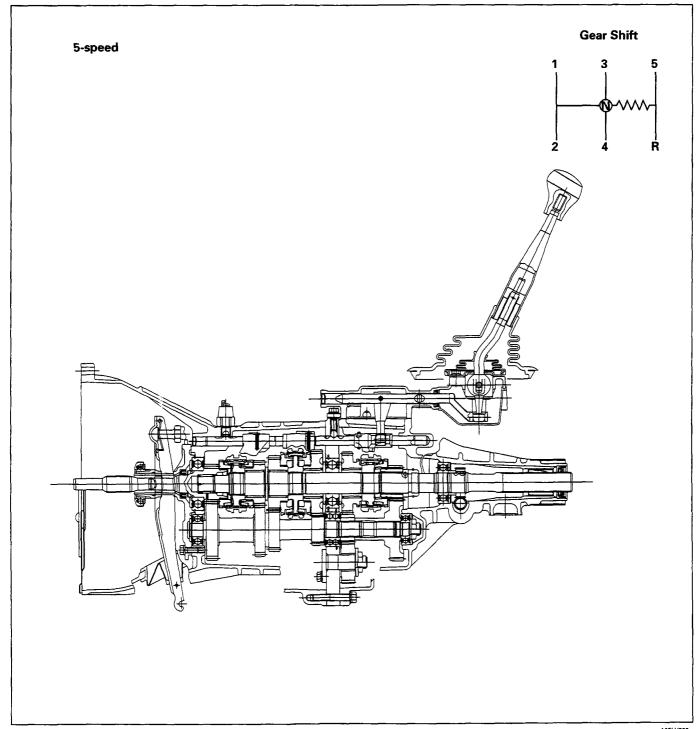
	PAGE	<u>:</u>
4 X 2 Model transmission	7B –	2
Main data and specifications	7B –	2
General description	7B –	3
Torque specifications	7B –	4
Repair kit	7B –	6
Removal and installation	7B –	7
Disassembly	7B –	15
Inspection and repair	7B –	25
Reassembly	7B –	29

#### **4 X 2 MODEL TRANSMISSION**

#### MAIN DATA AND SPECIFICATIONS

Transmission type		Fully synchonized 5-forward gears with a constant mesh type reverse gear.			
Transmission Control		Direct control with the gear shift lever on the floor.			
Gear ratio		5K			
		4.122			
		2.493			
		1.504			
		1.000			
		0.855			
		3.720			
Oil capacity	lit. (US gal.)	1.55 (0.41)			
Weight; approx.,	kg (lbs)	33.3 (73.8)			

#### **GENERAL DESCRIPTION**



A07LV002

The MSG type transmission is fully synchronized 5-speed unit with blocking ring type synchronizers and a constant mesh type reverse gear. The unit consists principally of a case with an integral clutch housing, intermediate plate, rear cover and gears. The top of the rear cover is a quadrant box containing the transmission control mechanism. The case and rear cover are cast aluminum alloy to reduce weight.

#### **TORQUE SPECIFICATION**



#### **STANDARD BOLTS**

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m / lb-ft)

	Strenath	Strength 4.8/4T 7T 8.8				9.8/9T
	Class		Refined		Non-Refined	3.6/31
				Reillied	Non-Renned	
\ `	Bolt Identifi-		(7)		(2)	(9)
	cation	4				
	Bolt					
\	Diameterx Pitch (mm)	No mark	<del></del>			
<u> </u>	M6 × 1.0	6 (0.6 / 52 lb·in)	7 (0.7 / 61 lb·in)	8 (0.8 /	69 lh.in)	
	M8 × 1.25	13 (1.3 / 113 lb·in)	17 (1.7 / 12)	}	0 / 14)	24 (2.4 / 17)
ļ ģ	M10 × 1.25	27 (2.8 / 20)	37 (3.8 / 27)	42 (4.		50 (5.1 / 37)
d A	M12 × 1.25	61 (6.3 / 45)	76 (7.8 / 56)	87 (8.		95 (9.7 / 70)
Standard Hex. Head Bolt	M14 × 1.5	96 (9.8 / 71)	116 (11.8 / 85)		3.6 / 98)	142 (14.5 / 105)
I	M16 × 1.5	130 (13.3 / 96)	170 (17.3 / 125)	193 (19	.7 / 143)	200 (20.4 / 148)
<u>š</u>	M18 × 1.5	188 (19.2 / 139)	244 (24.9 / 180)	278 (28	.3 / 205)	287 (29.3 / 212)
=	M20 × 1.5	258 (26.3 / 190)	337 (34.4 / 249)	385 (39	.3 / 284)	396 (40.4 / 292)
a	M22 × 1.5	332 (33.9 / 245)	453 (46.3 / 335)	517 (52	.7 / 381)	530 (54.1 / 391)
) E	M24 × 2.0	449 (45.8 / 331)	570 (58.2 / 421)		.3 / 480)	692 (70.6 / 511)
Sta	* M10 × 1.5	26 (2.7 / 20)	36 (3.7 / 27)		2 / 30)	48 (4.9 / 35)
"	* M12 × 1.75	57 (5.8 / 42)	71 (7.2 / 52)	80 (8.		89 (9.1 / 66)
	* M14 × 2.0	89 (9.1 / 66)	110 (11.2 / 81)		2.7 / 92)	133 (13.6 / 98)
	* M16 × 2.0	124 (12.7 / 92)	162 (16.5 / 119)		.9 / 137)	191 (19.5 / 141)
	M6 × 1.0	7 (0.7 / 61 lb-in)	8 (0.8 / 69 lb·in)	9 (0.9 /		-
	M8 × 1.25	15 (1.5 / 11)	19 (1.9 / 14)		2 / 16)	26 (2.7 / 20)
	M10 × 1.25	31 (3.2 / 23)	41 (4.2 / 30)	47 (4.		56 (5.7 / 41)
	M12 × 1.25 M14 × 1.5	69 (7.0 / 51)	85 (8.7 / 63) 126 (12.8 / 93)	97 (9.	9 / 72) .6 / 106)	106 (10.8 / 78) 154 (15.7 / 114)
	M16 × 1.5	104 (10.6 / 77) 145 (14.8 / 127)	188 (19.2 / 139)	214 (21		221 (22.5 / 163)
<del>∞</del>	M18 × 1.5	145 (14.0 / 127)	100 (13.2 / 133)	214 (21	.0 / 150/	221 (22.5 / 103)
<b>e</b>	M20 × 1.5	_	_		_	_
Flange Bolt	M22 × 1.5	_	_		_	_
Fla	M24 × 2.0	_			-	_
	* M10 × 1.5	30 (3.1 / 22)	40 (4.1 / 30)	46 (4.	7 / 34)	54 (5.5 / 40)
ļ	* M12 × 1.75	64 (6.5 / 47)	78 (8.0 / 58)	89 (9.		99 (10.1 / 73)
	* M14 × 2.0	97 (9.9 / 72)	119 (12.1 / 88)		8 / 99.7)	144 (14.7 / 107)
	* M16 × 2.0	137 (14.0 / 101)	178 (18.2 / 132)	t .	.7 / 150)	210 (21.5 / 155)

The asterisk \* indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.



#### **FLARE NUTS**

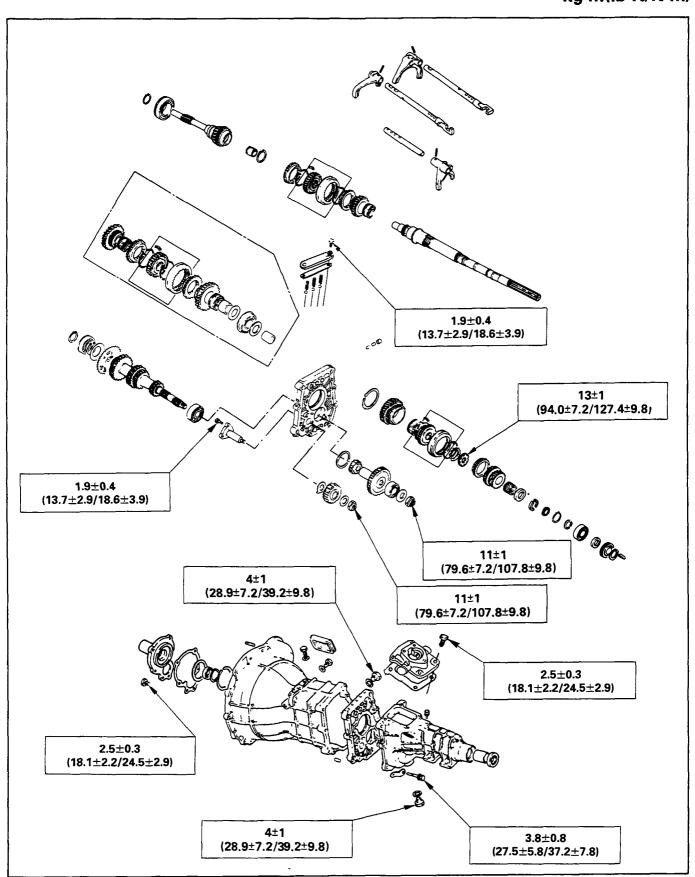
N·m (kg·m / lb·ft)

Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)

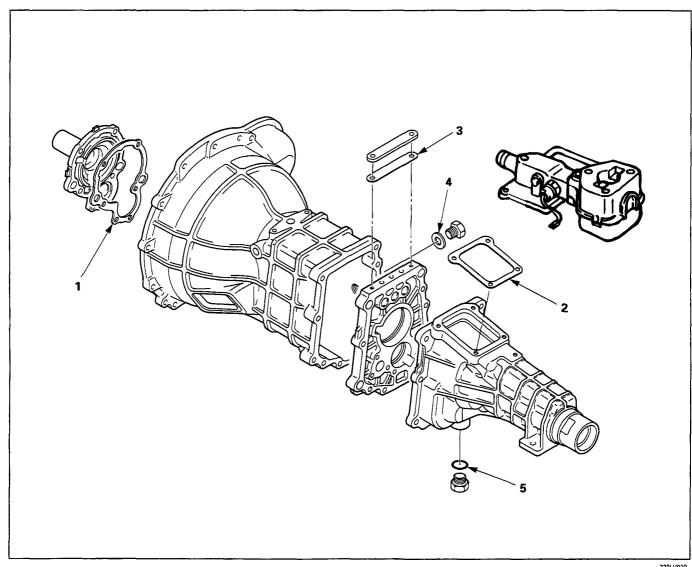


#### SPECIAL PARTS FIXING NUTS AND BOLTS

#### kg·m(lb·ft/N·m)



#### **REPAIR KIT**



220LV010

- 1. Case to front cover gasket
- 2. Control box gasket
- 3. Plate gasket

- 4. Filler plug O-ring
- 5. Drain plug O-ring





#### **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



#### Important Operations - Removal

#### **Battery Cable**

Disconnect the negative (-) cable from the battery terminal.

#### **Engine Hood**

Apply setting marks to the engine hood and the engine hood hinges before removing the engine hood.

#### **Gear Shift Lever**

- 1. Place the gear shift lever in the neutral position.
- 2. Remove the gear shift lever knob.
- 3. Remove the front console assembly.
- 4. Remove the gear shift lever grommet and dust cover.
- 5. Remove the gear shift lever cover bolts.
- 6. Remove the gear shift lever.

#### Note:

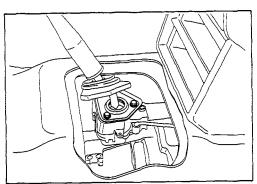
Cover the shift lever hole to prevent the entry of foreign material into the transmission.

#### Lifting the Vehicle

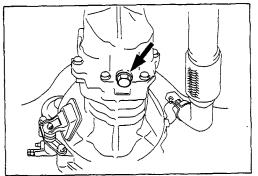
- 1. Jack up the vehicle.
- 2. Place chassis stands at the front and the rear of the vehicle.

#### Transmission Oil Draining

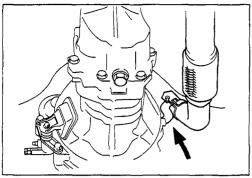
- 1. Remove the transmission oil drain plug.
- 2. Replace the drain plug after draining the oil.



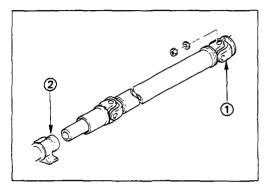
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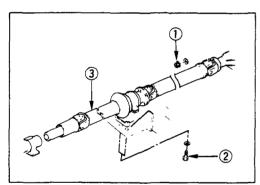


220LV020



220LV022





# 

#### **Exhaust Pipe**

- Remove the exhaust pipe bracket from the transmission case.
- 2. Remove the exhaust pipe.

#### Rear Propeller Shaft (Single Shaft Type)

- 1. Remove the propeller shaft flange yoke at the drive pinion side 1.
- 2. Remove the propeller shaft from the transmission main shaft spline (2).

#### Rear Propeller Shaft (Dual Shaft Type)

- Apply setting marks to the 2nd propeller shaft flange yoke.
  - This will prevent mispositioning during the installation procedure.
- 2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
- 3. Remove the center bearing retainer bolts 2.
- 4. Remove the 1st propeller shaft with the center bearing and the 2nd propeller shaft.
  - Pull the 1st propeller shaft toward the rear of the vehicle until the spline yoke is free of the transmission main shaft.

#### **Harness Connector**

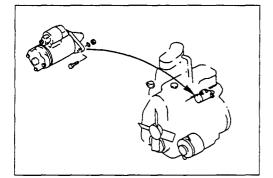
Disconnect the back up light switch connector and the speedometer sensor connector.

#### Slave Cylinder

Remove the slave cylinder from the transmission case.

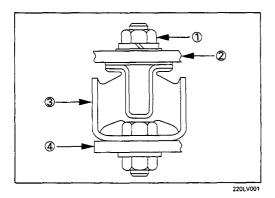
#### **Engine Lifting Hanger**

- 1. Attach the engine lifting hanger to the front portion of the engine.
- 2. Attach the lifting wire to both ends of the engine lifting hanger.



#### **Starter Motor**

Remove the starter motor from the engine rear plate.



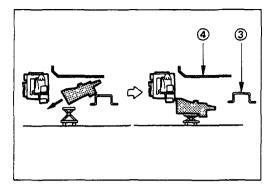
#### **Transmission**

- 1. Support the transmission with a transmission jack.
- 2. Remove the engine rear mounting rubber nuts 1 from the transmission 2.
- 3. Remove the rear mounting rubber 3 from the No. 3 crossmember 4.
- 4. Remove the gear control box from the transmission.
- 5. Remove the transmission from the engine.

The removal of the transmission will require the cooperative efforts of two mechanics.

- 1) Remove the transmission nuts and bolts 1 from the engine rear plate.
- 2) Place a transmission jack (2) beneath the transmission.

Do not raise the transmission jack.



- 3) Manually move the transmission as far as possible toward the rear of the vehicle (into the space between the No. 3 crossmember (3) and the floor panel (4).
- 4) Lower the clutch housing end of the transmission toward the transmission jack.

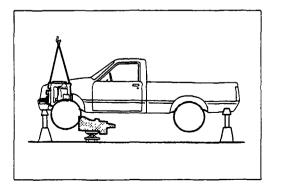
The rear of the transmission is supported by the No. 3 crossmember at this time.

5) Firmly grasp the transmission rear cover (1st mechanic).

Raise the transmission jack toward the transmission (2nd mechanic).

Carefully lower the transmission onto the transmission jack.

The transmission must be centered on the transmission jack.

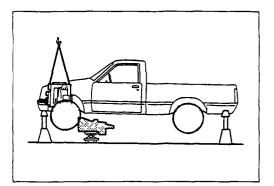


6. Carefully pull the transmission jack with the transmission from beneath the vehicle.



#### Important Operations — Installation

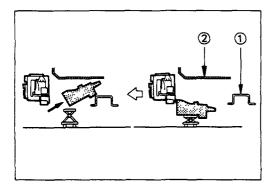
Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





#### **Transmission**

- 1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Place the transmission on a transmission jack.
- 3. Carefully move the transmission jack and transmission into position behind the engine.



- 4. Slowly operate the transmission jack to raise the transmission until the rear of the transmission is at the same level as the No. 3 crossmember (1).
- 5. Manually support the transmission rear cover. Move the transmission into position between the No. 3 crossmember and the floor panel (2).
- 6. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

The slope of the engine and the transmission must be the same.

- 7. Install the gear control box to the transmission.
- 8. Align the top gear shaft spline with the clutch drive



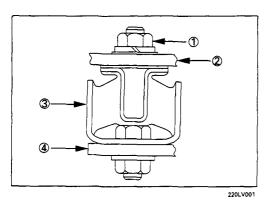
- plate spline. 9. Install the transmission to the engine.
  - Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque

 $kg \cdot m(lb \cdot ft/N \cdot m)$ 

M10: 4.1  $\pm$  1.0 (30  $\pm$  7.2 / 40  $\pm$  10)

M12:8.0  $\pm$  1.6 (58  $\pm$  12/78  $\pm$  16)





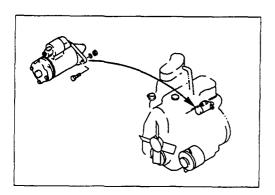
10. Install the rear mounting rubber ③ to the transmission ②.

Install the rear mounting rubber 3 to the No. 3 crossmember 4.

11. Tighten the rear mounting rubber nuts ① to the specified forque.

Rear Mounting Rubber Nut Torque	kg·m(lb·ft/N·m)
$4.2 \pm 0.5 (30 \pm 3.6/41)$	± 4.9)

Mounting Bolt Torgue	kg·m(lb			kg·m(lb·ft/N·m)	
$4.2 \pm 0.5$	(30	±	3.6 / 41	±	4.9)

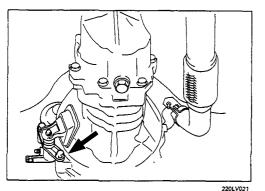




#### **Starter Motor**

- 1. Install the starter motor to the engine rear plate.
- 2. Tighten the starter motor bolts to the specified torque.

Starter Motor Bolt Torque	kg·m(lb·ft/N·		
$8.0 \pm 1.6$ (58	± 12/78 ±	16)	





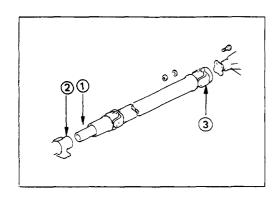
#### Slave Cylinder

Install the slave cylinder to the transmission case.

Slave Cylinder Bolt Torque	kg•m (lb•ft/N•m)
8.0 ± 1.6 (58 ±	± 12/78 ± 16)

#### **Harness Connector**

Connect the back up light switch connector and speedometer sensor connector.



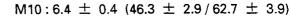


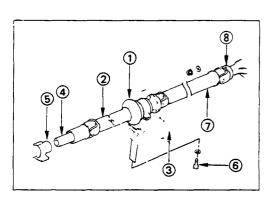
#### Rear Propeller Shaft (Single Shaft Type)

- 1. Insert the splined yoke (1) with the propeller shaft into the transmission main shaft spline (2).
- 2. Install the propeller shaft flange yoke 3 to the drive pinion side.
- 3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque kg·m(lb·ft/N·m)

M8: 3.6  $\pm$  0.3 (26.0  $\pm$  2.2/35.3  $\pm$  2.94)







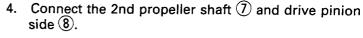
#### Rear Propeller Shaft (Dual Shaft Type)

- 1. Place the center bearing and retainer (1) together with the 1st propeller shaft 2 and 2nd propeller shaft 7 on the No. 4 crossmember 3.
- 2. Insert the splined yoke 4 into the transmission main shaft spline (5).
- 3. Tighten the center bearing retainer bolts 6 to the specified torque.

Center Bearing Retainer Bolt Torque  $kg \cdot m(lb \cdot ft/N \cdot m)$  $6.2 \pm 1.2 (44.8 \pm 8.7/60.8 \pm 11.8)$ 







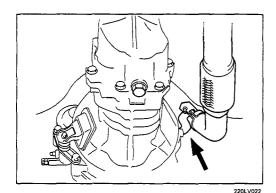
Be sure to align the setting marks applied at disassembly.

5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt

Torque  $kg \cdot m(lb \cdot ft/N \cdot m)$ M8: 3.6  $\pm$  0.3 (26.0  $\pm$  2.2 / 35.3  $\pm$  2.94)

M10: 6.4  $\pm$  0.4 (46.3  $\pm$  2.9 / 62.7  $\pm$  3.9)



#### **Exhaust Pipe**

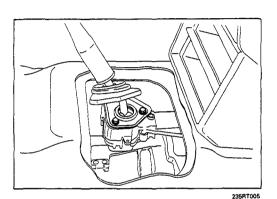
- 1. Install the exhaust pipe to the exhaust manifold and the 2nd exhaust pipe.
- 2. Install the exhaust pipe bracket to the transmission case.



#### Gear Shift Lever

1. Replenish the transmission case with the specified engine oil.

<u>Transmission Case Oil</u> lit (US gal.)





- 2. Install the gear shift lever to the gear control box.
- 3. Tighten the gear shift lever cover bolts to the specified torque.

Shift Lever Cover Bolt Torque	kg·m(lb·ft/N·m)
$2.0 \pm 0.2 (14.5 \pm 1.5/19.6)$	6 ± 1.96)

- 4. Install the dust cover and the grommet.
- 5. Install the front console assembly.
- 6. Install the gear shift lever knob.

#### Lowering the Vehicle

- 1. Place a jack beneath the vehicle.
- 2. Raise the jack to remove the chassis stands.
- 3. Lower the vehicle to the ground.

#### **Engine Hood**

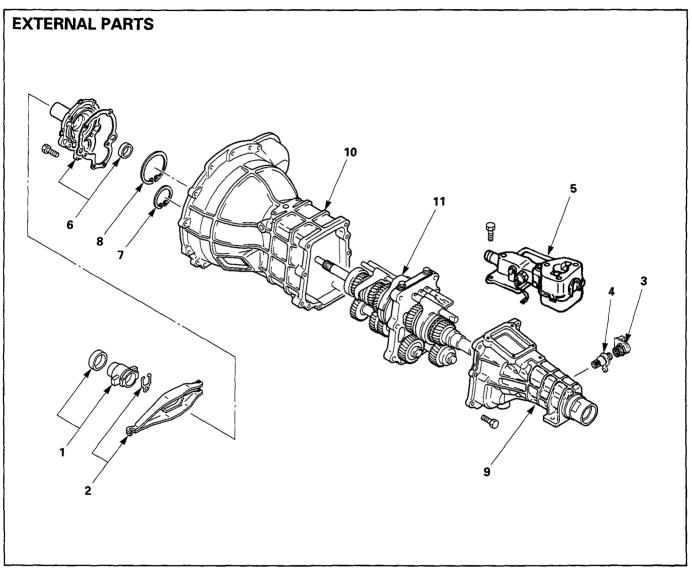
Align the setting marks(applied at removal)on the engine hood and the engine hood hinges to install the engine hood.

#### **Battery Cable**

Connect the negative (-) cable to the battery terminal.

### DISASSEMBLY

#### **MAJOR COMPONENTS**



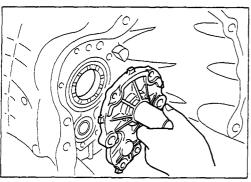
220LV007

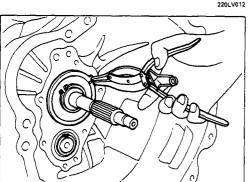
#### **Disassembly Steps**

- 1. Clutch shift block and release bearing
- 2. Clutch shift fork
- 3. Speedometer sensor
- 4. Speedometer driven gear assembly
- 5. Gear control box assembly
- ▲ 6. Front cover with oil seal

- ▲ 7. Counter gear snap ring
- ▲ 8. Bearing snap ring
  - 9. Rear cover with oil seal
  - 10. Transmission case
  - 11. Intermediate plate with gear assembly

#### 7B - 16 MSG MODEL (2WD)







#### **Important Operations**

#### 6. Front Cover with Oil Seal

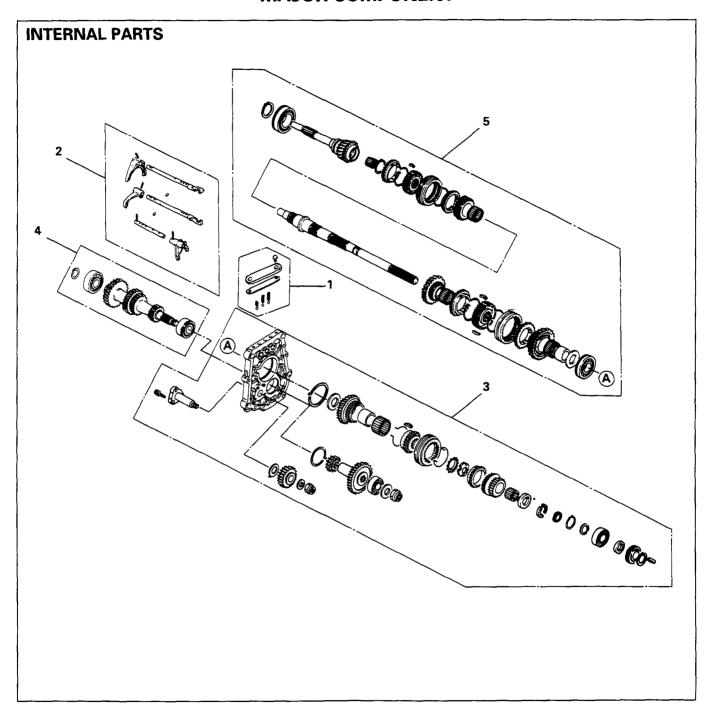
Remove the front cover with oil seal from the transmission case.

#### 7. Counter Gear Snap Ring

#### 8. Bearing Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

#### **MAJOR COMPONENT**



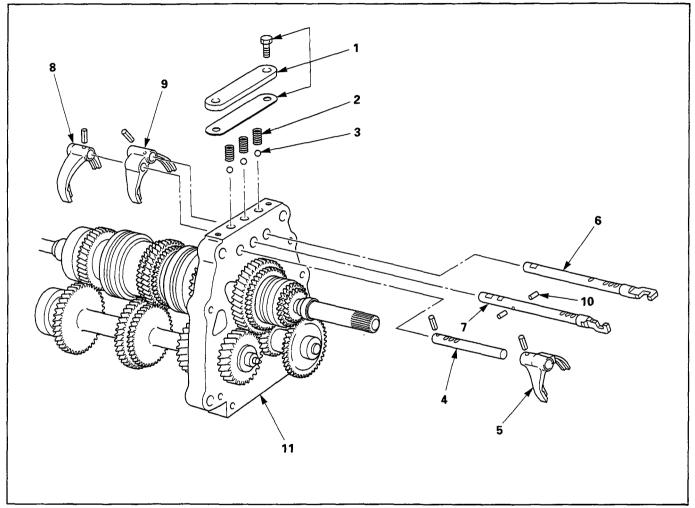
#### Disassembly steps

- 1. Detent assembly
- 2. Shift fork assembly & interlock pin
- 3. Rev. and 5th gear assembly
- 4. Counter gear shaft assembly
- 5. Top & main gear shaft assembly



#### **MINOR COMPONENTS**

#### DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN

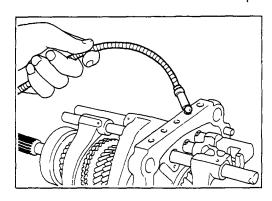


#### 220LV008

#### **Disassembly Steps**

- 1. Detent spring plate and gasket
- 2. Detent spring
- ▲ 3. Detent ball
  - 4. Rev. -5th shaft rod
  - 5. Rev. 5th shaft arm
  - 6. 1st-2nd shift rod

- ▲ 7. 3rd—4th shift rod
- ▲ 8. 3rd—4th shift arm
- ▲ 9. 1st-2nd shift arm
  - 10. Interlock pin
  - 11. Intermediate plate and gear assembly



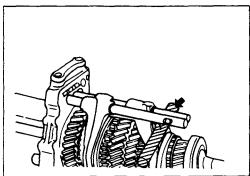


#### **Important Operations**

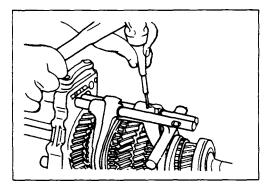
#### 3. Detent Ball

Use a magnetic hand to remove the detent balls from the intermediate plate.

Take care not to lose the detent balls.



- 7. 3rd-4th Shift Rod
- 8. 3rd-4th Shift Arm
- 9. 1st-2nd Shift Arm
- Hold a round bar against the shift arm end.
   This will prevent damage to other components.



2) Use a spring pin remover to remove the shift arm spring pin from the shift arm and the shift rod.

Spring Pin Remover: 9-8529-2201-0

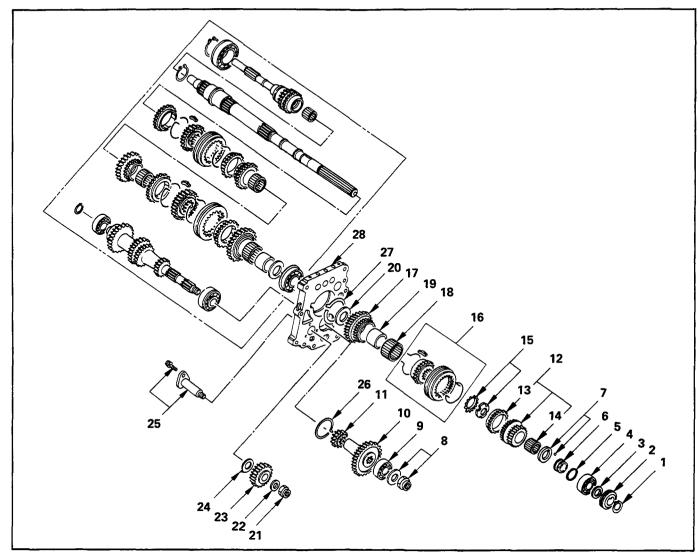
Discard the used spring pin.

3) Move the 3rd-4th shift rod forward.

Take care not to lose the interlock pins.



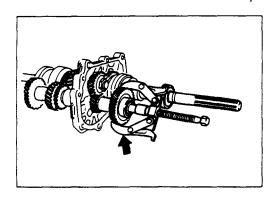
### **REVERSE GEAR AND 5TH GEAR**



#### **Disassembly Steps**

- 1. Bearing snap ring
- 3. Bearing spacer
- 4. Mainshaft end ball bearing
- 5. Thrust ring snap ring
- 6. Thrust washer thrust ring
- 7. Thrust washer and lock ball
- 8. Counter reverse gear nut and washer
- 9. Counter end ball bearing
- ▲ 10. Counter 5th gear
  - 11. Counter reverse gear
  - 12. 5th gear
  - 13. 5th block ring
  - 14. Needle bearing

- ▲ 15. Mainshaft lock nut and washer
- 2. Speedometer drive gear and lock ball 🔺 16. Rev. 5th synchronizer assembly
  - 17. Reverse gear
  - 18. Needle bearing
  - 19. Needle bearing collar
  - 20. Thrust washer
  - 21. Counter reverse gear lock nut
  - 22. Thrust washer
  - 23. Reverse idler gear
  - 24. Thrust washer
  - 25. Reverse idler shaft
  - ▲ 26. Bearing snap ring
  - ▲ 27. Bearing snap ring ▲ 28. Intermediate plate





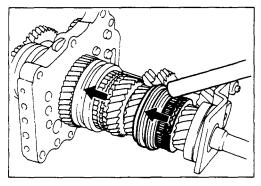
#### **Important Operations**

## 9. Counter End Ball Bearing

#### 10. Counter 5th Gear

Use the gear remover to remove the counter 5th gear with the ball bearing.

Gear Remover: 5-8840-0013-0 (J-22888)

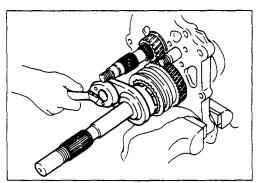




#### 15. Mainshaft Lock Nut and Washer

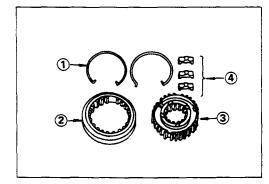
- 1) Engage the 3rd-4th synchronizer with the 3rd gear.
- 2) Engage the 1st-2nd synchronizer with the 1st gear.
- 3) Attach the holding fixture to the mainshaft and the countergear.

Holding Fixture: 5-8840-2001-0 (J-29768)





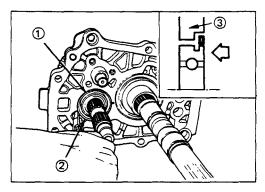
4) Use the lock nut wrench to remove the lock nut. Lock Nut Wrench: 5-8840-0353-0 (J-36629)





#### 16. Rev. — 5th Synchronizer Assembly

- 1) Remove the synchronizer assembly as a set.
- 2) Disassemble the synchronizer assembly.
  - (1) Springs
  - 2 Sleeve
  - (3) Clutch Hub
  - 4 Inserts



#### 26. Bearing Snap Ring

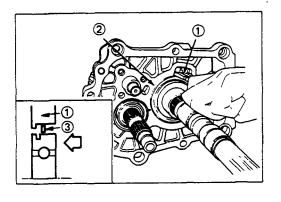
1) Insert the snap ring pliers ① into the counter gear bearing snap ring hole ②.

The snap ring hole is in the intermediate plate 3.

2) Use the snap ring pliers to force open the counter gear bearing snap ring.

Tap on the front of the intermediate plate.

The ball bearing snap ring will come free.



#### 27. Bearing Snap Ring

#### 28. Intermediate Plate

 Insert the snap ring pliers into the mainshaft bearing snap ring hole.

The snap ring hole is in the intermediate plate (1).

2) Use the snap ring pliers 2 to force open the mainshaft bearing snap ring 3.

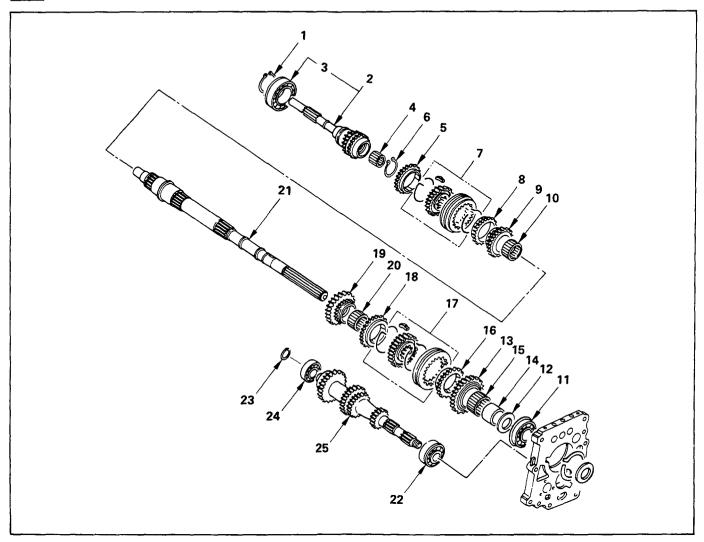
Hold the snap ring open with the pliers.

3) Push the intermediate plate toward the rear of the transmission to remove it.

The ball bearing snap ring will come free.



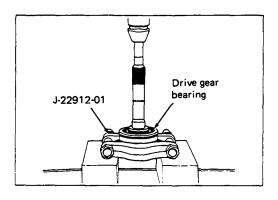
#### TOP GEAR SHAFT, MAINSHAFT GEAR AND COUNTER GEAR

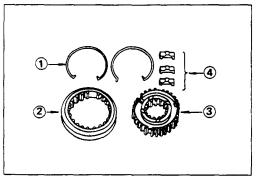


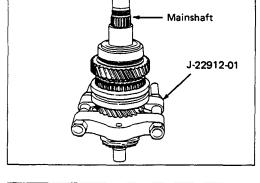
#### **Disassembly Steps**

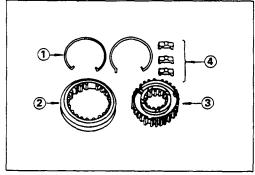
- ▲ 1. Top gear shaft snap ring
- 2. Top gear shaft
- 3. Ball bearing
  - 4. Needle bearing
  - 5. 4th block ring
  - 6. Mainshaft snap ring
- ↑ 7. 3rd—4th synchronizer assembly
  - 8. 3rd block ring
  - 9. 3rd gear
  - 10. Needle bearing
- ▲ 11. Mainshaft ball bearing
  - 12. 1st gear thrust washer
  - 13. 1st gear

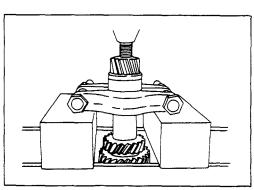
- 14. Needle bearing collar
- 15. Needle bearing
- 16. 1st block ring
- ▲ 17. 1st—2nd synchronizer assembly
  - 18. 2nd block ring
  - 19. 2nd gear
  - 20. Needle bearing
  - 21. Mainshaft
- ▲ 22. Rear ball bearing
  - 23. Bearing snap ring
- ▲ 24. Front ball bearing
  - 25. Counter gear













#### **Important Operations**

- 1. Top Gear Shaft Snap Ring
- 2. Top Gear Shaft
- 3. Ball Bearing
- 1) Use a pair of snap ring pliers to remove the snap ring.
- 2) Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)

- 7. 3rd-4th Synchronizer Assembly
- 1) Remove the synchronizer assembly as a set.
- 2) Disassembly the synchronizer assembly.
  - 1) Springs
  - 2 Sleeve
  - (3) Clutch Hub
  - (4) Inserts



#### 11. Mainshaft Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)

#### 17. 1st—2nd Synchronizer Assembly

- 1) Remove the synchronizer assembly as a set.
- 2) Disassembly the synchronizer assembly.
  - (1) Springs
  - 2 Sleeve
  - 3 Clutch Hub
  - 4 Inserts



#### 22. Rear Ball Bearing

#### 24. Front Ball Bearing

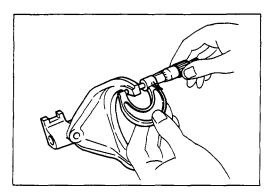
Use a bench press and the bearing remover to remove the ball bearing.

Bearing Removar: 5-8840-0015-0 (J-22912-01)



## **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

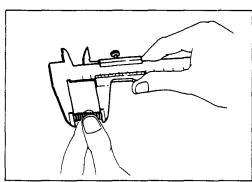




#### SHIFT ARM THICKNESS

Use a micrometer to measure the shift arm thickness. If the measured value is less than the specified limit, the shift arm must be replaced.

Shift Arm Thickness		mm(in)	
	Standard	Limit	
1st-2nd	9.6-9.8 (0.378-0.386)	9.0 (0.354)	
3rd-4th	6.95-7.2 (0.273-0.283)	6.5 (0.256)	
Rev5th	6.8-6.9 (0.268-0.272)	6.3 (0.248)	



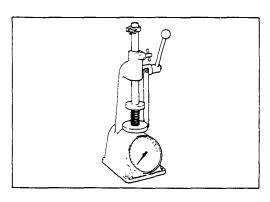


#### **DETENT SPRING FREE LENGTH**

Use a venier caliper to measure the detent spring free length.

If the measured value is less than the specified limit, the detent spring must be replaced.

Detent Spring Free Length	mm(in)
Standard	Limit
25.6 (1.01)	23.6 (0.93)



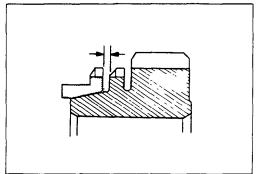


#### **DETENT SPRING TENSION**

Use a spring tester to measure the valve spring tension.

If the measured value is less than the specified limit, the valve spring must be replaced.

Valve Spring Tension		kg(lb/N)	
Compressed Height mm(in)	Standard	Limit	
22.1 (0.870)	6.3-6.7 (13.9-14.8 / 61.8-65.7)	5.7 (12.6/55.9)	



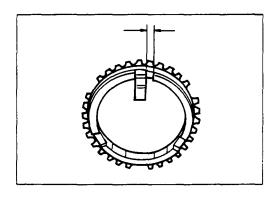


#### **BLOCK RING AND DOG TEETH CLEARANCE**

Use a thickness gauge to measure the clearance between the block ring and the dog teeth.

If the measured value exceeds the specified limit, the block ring must be replaced.

Block Ring and Do	g Teeth Clearance	mm(in)
	Standard	Limit
1st, 2nd	2.0 (0.078)	1.3 (0.051)
3rd, 4th, 5th	1.5 (0.059)	0.8 (0.032)



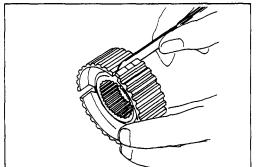


#### **BLOCK RING AND INSERT CLEARANCE**

Use a thickness gauge to measure the clearance between the block ring and the insert.

If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block Ring and Insert Clearance		mm(in)
	Standard	Limit
1st, 2nd	3.46-3.74 (0.136-0.147)	40 (0 157)
3rd, 4th, 5th	3.51-3.79 (0.138-0.149)	4.0 (0.157)



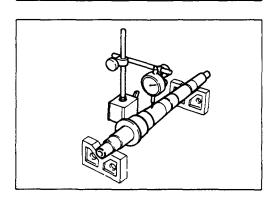


#### **CLUTCH HUB AND INSERT CLEARANCE**

Use a thickness gauge to measure the clearance between the clutch hub and the insert.

If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch Hub and Insert Clearance	mm(in)
Standard	Limit
0.01 - 0.19 (0.0004 - 0.0075)	0.3 (0.012)



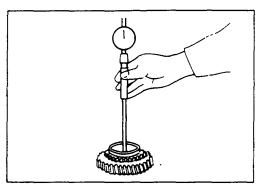


#### MAINSHAFT RUN-OUT

- 1. Install the mainshaft to a grinding machine.
- 2. Use a dial indicator to measure the mainshaft central portion run-out.

If the measured mainshaft run-out exceeds the specified limit, the mainshaft must be replaced.

Mainshaft Run-Out	mm(in)
Limit	
Less than 0.03 (0.0012)	





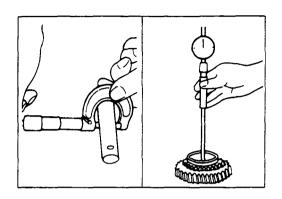
#### **GEAR INSIDE DIAMETER**

Use an inside dial indicator to measure the gear inside diameter.

If the measured value is less than the specified limit, the gear must be replaced.

Chandond	1::4
Gear Inside Diameter	mm(in)
godi mast be replaced.	

	Standard	Limit
1st Rev.	45.00 <i>–</i> 45.01 (1.7717 <i>–</i> 1.7720)	45.10 (1.7756)
2nd 3rd	41.00-41.01 (1.6142-1.6146)	41.10 (1.6181)
5th	34.03 <i>-</i> 34.04 (1.3398 <i>-</i> 1.3402)	34.10 (1.3425)



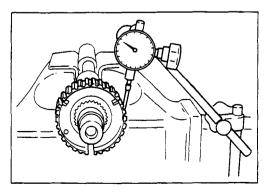


## REVERSE IDLER GEAR AND IDLER GEAR SHAFT CLEARANCE

- 1. Use a micrometer to measure the idler gear shaft diameter.
- 2. Use an inside dial indicator to measure the idler gear inside diameter.
- Calculate the idler gear and idler gear shaft clearance.
   Idler gear inside diameter idler gear shaft diameter = idler gear and idler gear shaft clearance.

If the measured value exceeds the specified limit, the idler gear and/or the idler gear shaft must be replaced.

idler Gear and idler Gear Shaft Cleara	nce mm(in)
Standard	Limit
0.041 - 0.074 (0.0016 - 0.0029)	0.150 (0.0059)





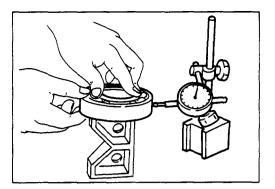
#### **CLUTCH HUB SPLINE PLAY**

- 1. Set a dial indicator to the clutch hub to be measured.
- 2. Move the clutch hub as far as possible to both the right and the left.

Note the dial indicator reading.

It the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch Hub Spline Play	mm(in)
Standard	Limit
0 - 0.19 (0 - 0.0075)	0.20 (0.0079)





#### **BALL BEARING PLAY**

Use a dial indicator to measure the ball bearing play.

Ball Bearing Play	mm(in)
Limit	
0.2(0.0079	1)

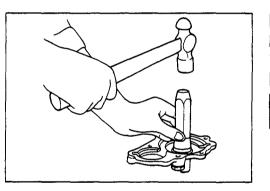


## FRONT COVER OIL SEAL

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the front cover.





#### Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the front cover.

Oil Seal Installer: 5-8840-0026-0 (J-26540)

2. Apply engine oil to the oil seal lip.

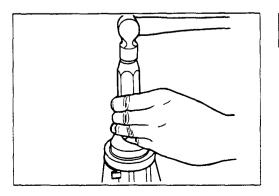


#### **REAR COVER OIL SEAL**

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the rear cover.





#### Oil Seal Installation

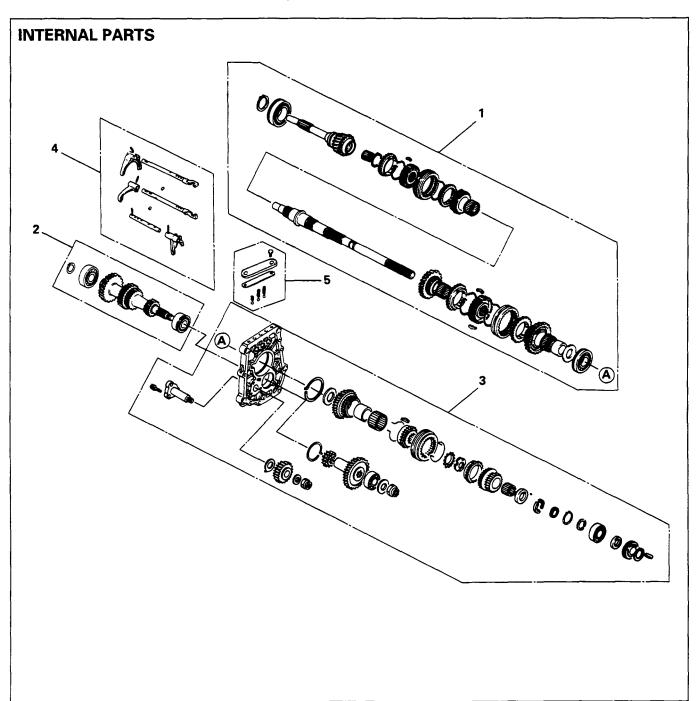
1. Use the oil seal installer to install the oil seal to the rear cover.

Oil Seal Installer: 5-8522-0050-0 (J-29769)

2. Apply engine oil to the oil seal lip.



#### **MAJOR COMPONENT**



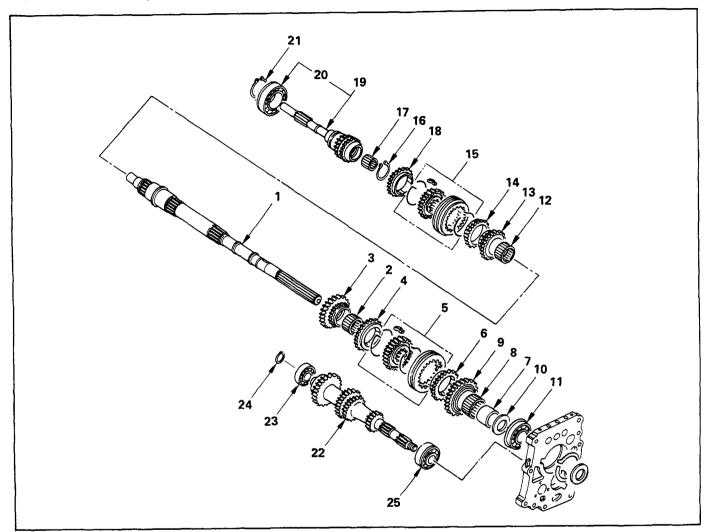
## Reassembly steps

- 1. Top & main gear shaft assembly
- 2. Counter gear shaft assembly
- 3. Rev. and 5th gear assembly
- 4. Shift fork assembly & interlock pin
- 5. Detent assembly

## +\*+

## MINOR COMPONENTS

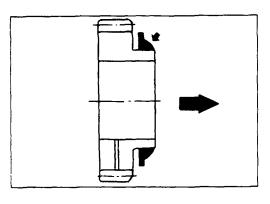
## TOP GEAR SHAFT, MAINSHAFT GEAR AND COUNTER GEAR



#### **Reassembly Steps**

- 1. Mainshaft
- ▲ 2. Needle bearing
- ▲ 3. 2nd gear
  - 4. 2nd block ring
- ▲ 5. 1st—2nd synchronizer assembly
  - 6. 1st block ring
- ▲ 7. Needle bearing collar
- 8. Needle bearing
- ▲ 9. 1st gear
- ▲ 10. 1st gear thrust washer
- ▲ 11. Mainshaft ball bearing
- ▲ 12. Needle bearing
- ▲ 13. 3rd gear

- 14. 3rd block ring
- ▲ 15. 3rd—4th synchronizer assembly
- ▲ 16. Mainshaft snap ring
  - 17. Needle bearing
  - 18. 4th block ring
- ▲ 19. Top gear shaft
- ▲ 20. Ball bearing
  - 21. Top gear shaft snap ring
  - 22. Counter gear
  - 23. Front ball bearing
  - 24. Bearing snap ring
- ▲ 25. Rear ball bearing





#### **Important Operations**



#### 2. Needle Bearing

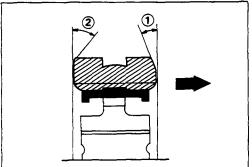


#### 3. 2nd Gear



- 1) Apply the engine oil to the 2nd needle bearing and the 2nd gear.
- 2) Install the needle bearing and the 2nd gear to the mainshaft.

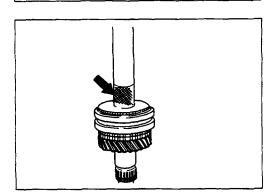
The dog teeth of the 2nd gear must be facing the rear side of the transmission.





#### 5. 1st-2nd Synchronizer Assembly

- 1) Apply the engine oil to the clutch hub spline.
- 2) Install the synchronizer assembly to the mainshaft. The outside sleeve heavy chamfering must be facing the rear of the transmission.
  - Chamfer Angle = 30°
  - ② Chamfer Angle = 45°

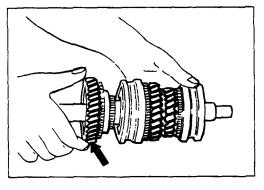




#### 7. Needle Bearing Collar

Use a bench press and the collar installer to install the needle bearing collar.

Collar Installer: 5-8840-0178-0 (J-33851)





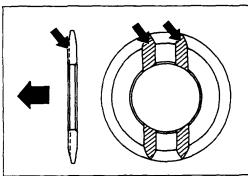
#### 8. Needle Bearing





- 1) Apply the engine oil to the 1st needle bearing and the 1st gear.
- 2) Install the needle bearing and the gear to the mainshaft.

The dog teeth of the 1st gear must be facing the front side of the transmission.

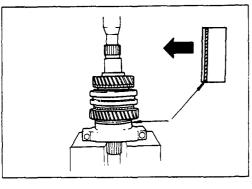




#### 10. 1st Gear Thrust Washer

Install the thrust washer to the mainshaft.

The thrust washer oil groove must be facing the 1st gear side.







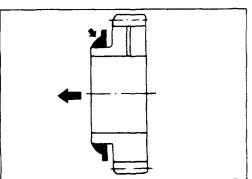


#### 11. Mainshaft Ball Bearing

- 1) Apply the engine oil to the ball bearing inside circum-
- 2) Use a bench press and the bearing installer to install the bearing.

The bearing snap ring groove must be facing the front of the transmission.

Bearing Installer: 5-8840-0015-0 (J-22912-01)



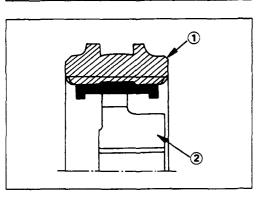


#### 12. Needle Bearing

#### 13. 3rd Gear

- 1) Apply the engine oil to the 3rd needle bearing and the 3rd gear.
- 2) Install the needle bearing and the gear to the mainshaft.

The dog teeth of the 3rd gear must be facing the front side of the transmission.

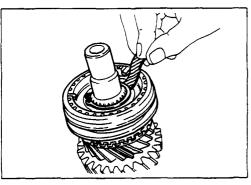






#### 15. 3rd—4th Synchronizer Assembly

- 1) Apply the recommended lubricating oil to the clutch hub spline.
- 2) Install the synchronizer assembly to the mainshaft. The sleeve light chamfering (1) and the clutch hub heavy boss (2) must be facing the rear of the transmission.





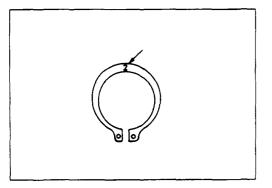
#### 16. Mainshaft Snap Ring

1) Select the snap ring which will provide the minimum clearance between the mainshaft and the snap ring.

There are four snap ring sizes available.

The snap rings are numbered to indicate their thickness.

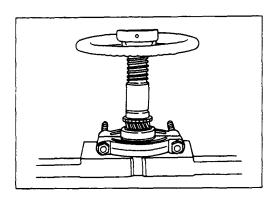
Mainshaft and Snap Ring Clearance	mm(in)
Standard	
0 - 0.05 (0.002)	
Snap Ring Availability	mm(in)





Snap Ring Availability	mm(in)
Thickness	Identification Number
1.50 (0.059)	1
1.55 (0.061)	2
1.60 (0.063)	3
1.65 (0.065)	4

2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.





#### 19. Top Gear Shaft

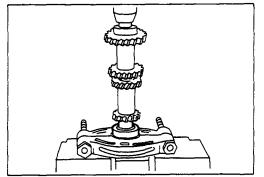
#### 20. Ball Bearing



Use a bench press and the installer to install the ball bearing to the top gear shaft.

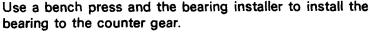
The snap ring groove must be facing the front of the transmission.

Bearing Installer: 5-8840-0015-0 (J-22912-01)





#### 25. Rear Ball Bearing

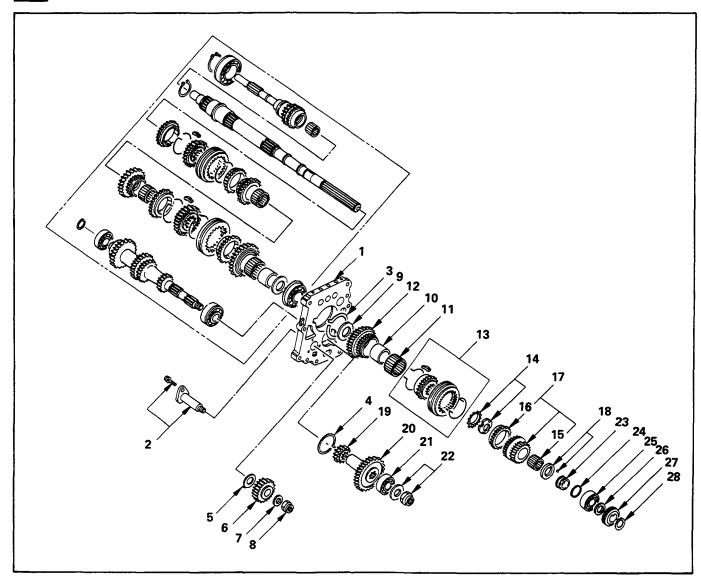




Bearing Installer: 5-8840-0015-0 (J-22912-01)



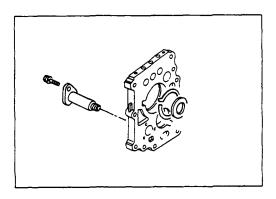
#### **REVERSE GEAR AND 5TH GEAR**



#### **Reassembly Steps**

- ▲ 1. Intermediate plate
- ▲ 2. Reverse idler shaft
  - 3. Bearing snap ring
  - 4. Bearing snap ring
  - 5. Thrust washer
- ▲ 6. Reverse idler gear
  - 7. Thrust washer
- 8. Counter reverse gear lock nut
- ▲ 9. Thrust washer
  - 10. Needle bearing collar
  - 11. Needle bearing
  - 12. Reverse gear
- ▲ 13. Rev. 5th synchronizer assembly
- ▲ 14. Mainshaft lock nut and washer

- 15. Needle bearing
- 16. 5th block ring
- 17. 5th gear
- ▲ 18. Thrust washer and lock ball
  - 19. Counter reverse gear
  - 20. Counter 5th gear
  - 21. Counter end ball bearing
- ▲ 22. Counter reverse gear nut and washer
- ▲ 23. Thrust washer thrust ring
- ▲ 24. Thrust ring snap ring
  - 25. Mainshaft end ball bearing
- 26. Bearing spacer
- 27. Speedometer drive gear and lock ball
- 28. Bearing snap ring





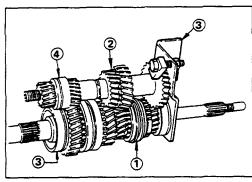
#### **Important Operations**

- 1. Intermediate Plate
- 2. Reverse Idler Shaft
- 1) Install the reverse idler shaft to the intermediate plate.
- 2) Tighten the reverse idler shaft bolt to the specified torque.

Idler Shaft Bolt Torque

kg·m(lb.ft/N·m)

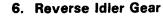
 $1.9 \pm 0.4 (13.7 \pm 2.9 / 18.6 \pm 3.9)$ 





- 3) Set the mainshaft with gear assembly (1) and the counter gear assembly (2) to the holding fixture (3). Holding Fixture: 5-8840-2001-0 (J-29768)
- 4) Place the holding fixture (with the mainshaft and the counter shaft) in a vise.
- 5) Mesh the 3rd—4th synchronizer to the 3rd gear. Mesh the 1st-2nd synchronizer to the 1st gear.
- 6) Install the intermediate plate to the mainshaft and the counter gear ball bearings.



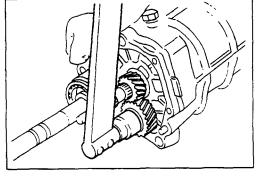


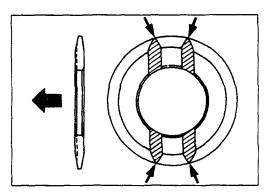
- 8. Counter Reverse Gear Lock Nut
- 1) Apply the engine oil to the idler shaft and the reverse gear inside circumference.
- 2) Install the reverse gear to the idler shaft.
- 3) Install a new counter reverse gear lock nut. Never reinstall the old lock nut.
- 4) Tighten the reverse gear lock nut to the specified torque.

Lock Nut Torque

 $kg \cdot m(lb.ft/N \cdot m)$ 

 $11 \pm 1.0 (79.6 \pm 7.2/107.8 \pm 9.8)$ 

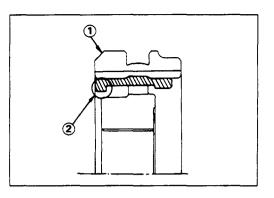






#### 9. Thrust Washer

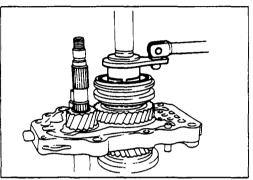
- 1) Apply the engine oil to both sides of the thrust washer.
- 2) Install the thrust washer to the mainshaft. The thrust washer oil groove must be facing the reverse gear side.





#### 13. Rev. - 5th Synchronizer Assembly

- 1) Apply the engine oil to the clutch hub spline.
- 2) Install the synchronizer assembly to the mainshaft. The sleeve heavy chamfer ① and the insert short side ② must be facing the rear side of the transmission.





#### 14. Mainshaft Lock Nut and Washer

- Install a new lock nut and washer to the mainshaft.
   Never reinstall the used lock nut and washer.
- 2) Use the lock nut wrench to tighten the lock nut to the specified torque.

Lock Nut Wrench: 5-8840-0353-0 (J-36629)

Lock Nut Torque kg⋅m(lb.ft/N⋅m)

11 ± 1.0 (79.6 ± 7.2 / 107.8 ± 9.8)

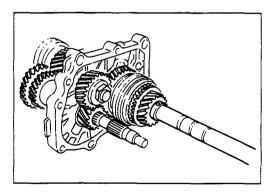


#### 22. Counter Reverse Gear Nut and Washer

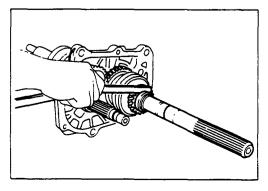
Tighten the counter gear lock nut to the specified torque.

Reverse Gear Nut Torque kg·m(lb.ft/N·m)

11  $\pm$  1.0 (79.6  $\pm$  7.2 / 107.8  $\pm$  9.8)



- 18. Thrust Washer and Lock Ball
- 23. Thrust Washer Thrust Ring
- 24. Thrust Ring Snap Ring
  - 1) Install the thrust washer with lock ball together with the thrust ring to the mainshaft.
  - Use a pair of snap ring pliers to install the snap ring.



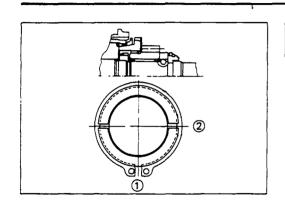


3) Use a thickness gauge to measure the clearance between the 5th gear and the thrust washer.

5th Gear and Thrust Washer Clearance mm(in)

Standard 0.1 - 0.3 (0.004 - 0.012)

If required, replace the existing thrust washer with a new thrust washer to bring the clearance to specification.





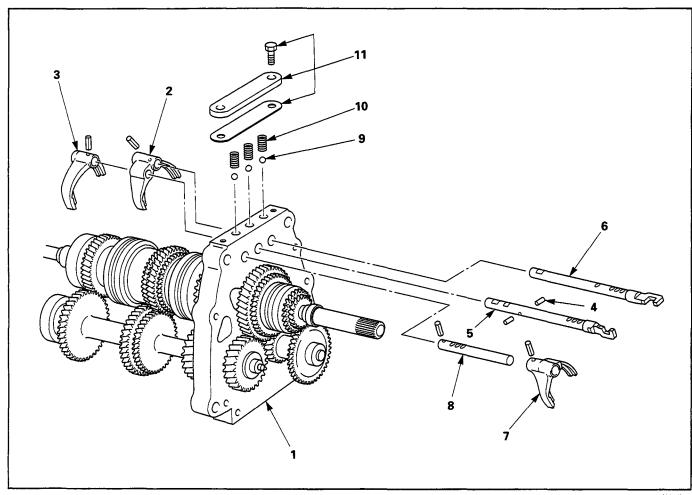
There are six thrust washer sizes available.

Thrust Washer Availability		<u>mm(in</u> )
7.8 (0.307)	7.9 (0.311)	8.0 (0.315)
8.1 (0.319)	8.2 (0.323)	8.3 (0.327)

4) Position the thrust ring snap ring gap ① and the thrust ring gap ② so that they are separated at a 90° angle.



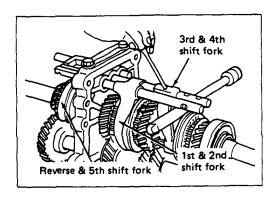
#### **DETENT AND SHIFT ARM ASSEMBLY**



#### **Reassembly Steps**

- 1. Intermediate plate and gear assembly ▲ 7. Rev. 5th shift arm
- 2. 1st—2nd shift arm
- 3. 3rd—4th shift arm
  - 4. Interlock pin
  - 5. 3rd—4th shift rod
  - 6. 1st-2nd shift rod

- - 8. Rev. 5th shift rod
  - 9. Detent ball
- 10. Detent spring
- ▲ 11. Detent spring plate and gasket

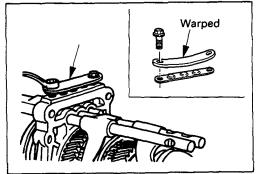




#### **Important Operations**

- 2. 1st-2nd Shift Arm
- 3. 3rd-4th Shift Arm
- 7. Rev. 5th Shift Arm
- 1) Hold a round bar against the shift rod end lower face to protect it against damage.
- 2) Use a spring pin installer to install the spring pin to the shift arm and the shift rod.

Never reinstall the used spring pins.





#### 11. Detent Spring Plate and Gasket.

- 1) Install the new detent plete and new gasket onto the transmission case into the correct direction.
- 2) Tighten the detent spring plate bolts to the specified torque.

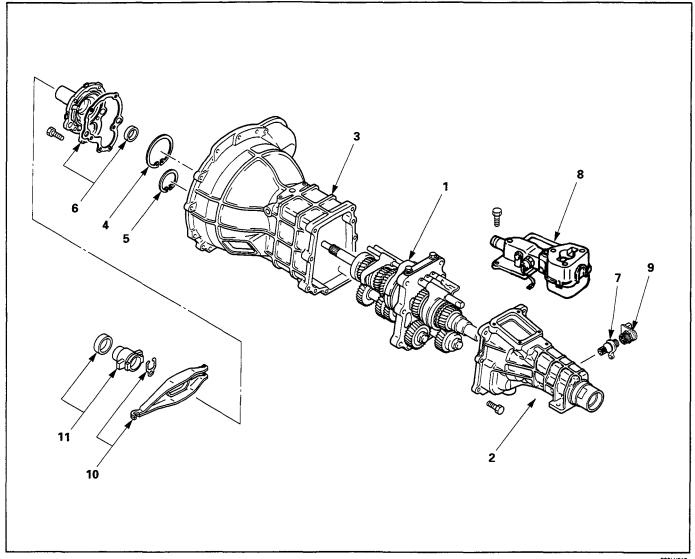
Detent Spring Plate Bolt Torque

kg·m(lb.ft/N·m)

 $1.9 \pm 0.4 (13.7 \pm 2.9 / 18.6 \pm 3.9)$ 



#### **MAJOR COMPONENTS**

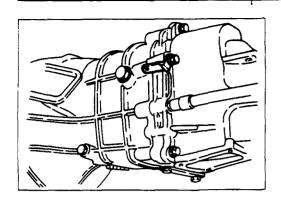


220LV015

#### **Reassembly Steps**

- 1. Intermediate plate with gear assembly
- 2. Rear cover with oil seal
- 3. Transmission case
- 4. Bearing snap ring
  - 5. Counter gear snap ring

- ▲ 6. Front cover with oil seal
  - 7. Speedometer driven gear
  - 8. Gear control box assembly
  - 9. Speedpmeter sensor
  - 10. Clutch shift fork
  - 11. Clutch shift block and release bearing





### 7 Important Operations

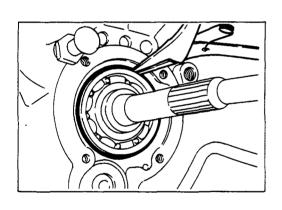
#### 2. Rear Cover with Oil Seal

- 1) Align the pins at the lower side of the rear cover with the holes in the lower side of the intermediate plate.
- 2) Apply recommended liquid gasket or its equivalent to the rear cover fitting surfaces.
- 3) Install the rear cover to the intermediate plate.
- 4) Tighten the rear cover bolts to the specified torque.

Rear Cover Bolt	Torque	kg•m (Ib•ft/N•m)
3.8 ±	0.8 (27.5 ±	5.8 / 37.2 ± 7.8)

#### Note:

Take care not to twist or puncture the oil seal during the installation procedure.

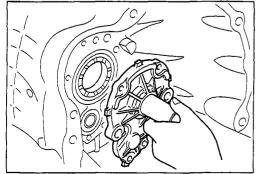




#### 3. Transmission Case

#### 4. Bearing Snap Ring

- 1) Apply the engine oil to the transmission case top gear shaft ball bearing fitting faces.
- 2) Apply recommended liquid gasket or its equivalent to the transmission case fitting surfaces.
- 3) Install the transmission case to the intermediate plate.
- 4) Pull the top gear shaft from the transmission case until the ball bearing snap ring groove protrudes from the transmission case front cover fitting fece.
- 5) Use a pair of snap ring pliers to install the snap ring to the ball bearing.





#### 6. Front Cover with Oil Seal

- 1) Clean and apply recommended liquid gasket or its equivalent to the through bolt threads.
- 2) Install the new gasket and tighten the new cover bolt to the specified torque.

Front Cover Bolt Torgue	<u> </u>	kg•m (Ib•ft/N•m)
2.5 ± 0.3 (1	$8.1 \pm 2.2/24.5$	± 2.9)











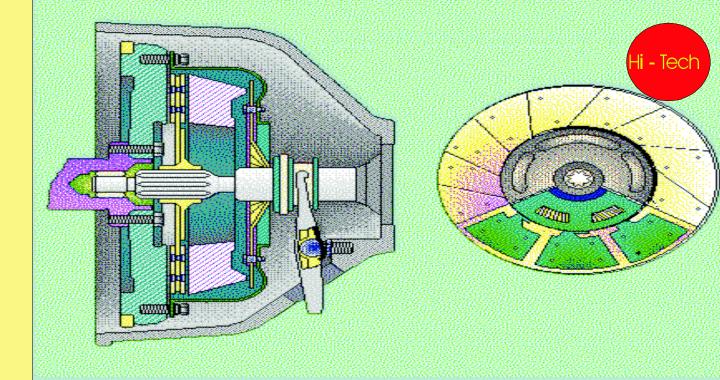
Servicing

Removal

Master Cyl.

Slave Cyl.

Damper



# KB TF 140 Clutch



# SECTION 7C CLUTCH

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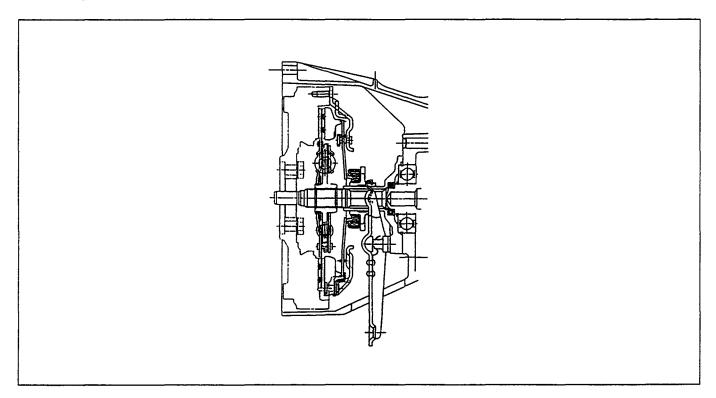
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## MAIN DATA AND SPECIFICATIONS

ENGINE		4ZC1	4JA1	4ZE1	4JB1T
Type		Dry single plate with diaphragm			
Size	mm (in)	215 (8.465)	225 (8.858)	 	240 (9.449)
Clamping force	kg (lb)	486 (1072)	500 (1103)	į 	560 (1235)
	(N)	(4766)	(4903)		(5492)
Pressure plate					
Outside diameter	mm (in)	215 (8.465)	225 (8.858)		240 (9.449)
Inside diameter	mm (in)	154 (6.063)	154 (6.063)		160 (6.299)
Driven plate					
Thickness	mm (in)			ĺ	
at free		8.0 (0	).315)	8.2 (0.323)	8.0 (0.315)
at compressed		7.8 (0	).307)	8.0 (0.315)	7.8 (0.307)
CLUTCH CONTROL		RHD			
Type			Hydr	aulic	
Pedal free play	mm (in)			(0.2-0.6)	
Pedal height	mm (in)	216—226 (8.50—8.90)			
	, ,	1			
Master cylinder			45.07 . 05.4	0.005 . 4.00	
Bore x Stroke	mm (in)		15.87 x 35 (	0.625 x 1.38)	
Slave cylinder					
Bore x Stroke	mm (in)				
4ZC1/4ZC1/4JA1			20.64 x 16 (	0.813 x 0.63)	
4ZE1/4JB1T			22.22 x 15 (	0.875 x 0.59)	

## **GENERAL DESCRIPTION**

#### HYDRAULIC CONTROL TYPE



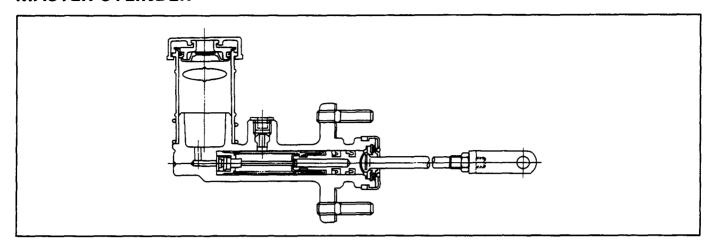
The clutch assembly consists of the pressure plate, the clutch cover, the diaphragm spring pivot pin, and the driven plate assembly.

The clutch pedal is connected to the shift block through the clutch shaft and the shift fork.

The driven plate assembly is installed between the flywheel and the pressure plate. Diaphragm spring pressure holds the driven plate against flywheel and the pressure plate to provide the friction necessary to engage the clutch.

Depressing the clutch pedal moves the shift fork against the shift block. The shift block forces the release bearing against the diaphragm to overcome the force of the diaphragm spring and separate the driven plate from the flywheel and pressure plate to disengage the clutch.

#### MASTER CYLINDER



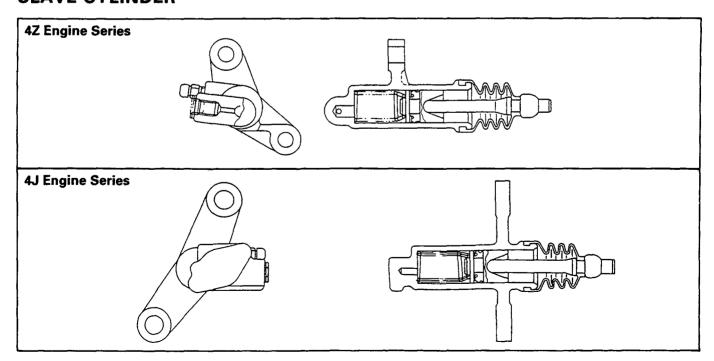
The master cylinder converts mechanical energy into hydraulic energy.

Depressing the clutch pedal causes the push rod to move against the piston to close the return port. Clutch fluid is forced out of the master cylinder.

Releasing the clutch pedal causes the return spring to force the piston back to its original position. The return port is opened and the clutch fluid flows back into the fluid reservoir.

Quickly releasing the clutch pedal will cause the fluid pressure at the return spring side to be lower than the fluid pressure at the push rod side. This allows the fluid at the push rod side to quickly flow to the return spring side through a port in the piston head. This equalizes the pressure at both sides of the piston.

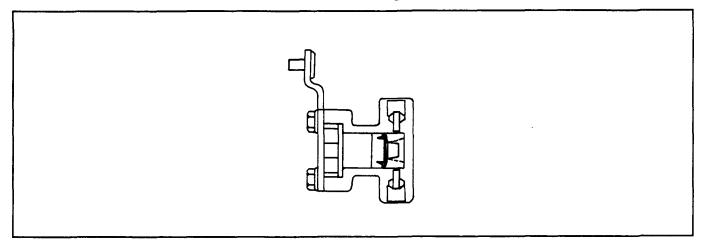
#### **SLAVE CYLINDER**



The slave cylinder converts hydraulic energy into mechanical energy. Hydraulic fluid supplied by the master cylinder moves the slave cylinder piston to actuate the shift fork. The mechanical energy produced by the slave cylinder is directly proportional to the diameters of the master cylinder and the slave cylinder.

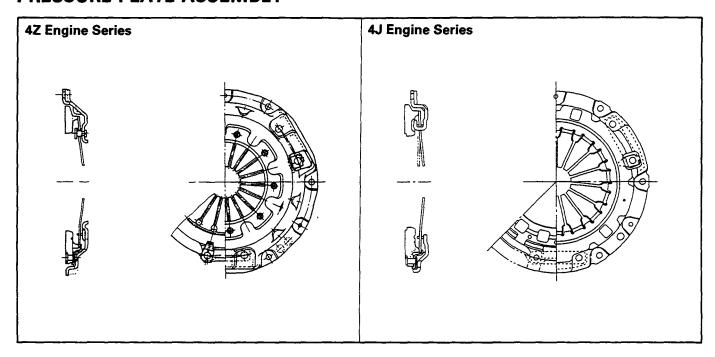
A bleeder screw is provided to bleed the slave cylinder.

## **HYDRAULIC DAMPER CYLINDER (FOR 4J Engine Series)**



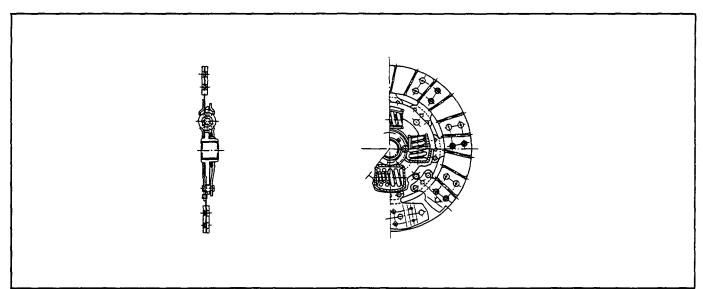
The hydraulic damper cylinder is installed between the master cylinder and the slave cylinder to smooth out variations in clutch pedal feel.

#### PRESSURE PLATE ASSEMBLY



The pressure plate assembly consists of the clutch cover, the pressure plate with diaphragm spring. Operating the clutch pedal causes the pressure plate to move in an axial direction to engage and disengage the clutch.

#### DRIVEN PLATE ASSEMBLY



The driven plate assembly consists of the plate and the facing.

The plate consists of the clutch center, the cushioning plate, and the torsion springs.

The facing is riveted to both sides of the cushioning plate.

The cushioning plate provides a longer service life by minimizing wear and vibration at the clutch contact surfaces.

## **TORQUE SPECIFICATIONS**

## **₹** STANDARD BOLTS

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m / lb·ft)

	Strength	40/47				0.0/0=
V _	Class	4.8/4T	7 <b>T</b>	L	.8	9.8/9T
	-			Refined	Non-Refined	
\ \	Bolt		$\widehat{7}$	(a)	(a)	
	Identifi- cation	4				
	Bolt					
\	Diameterx	No mark				
\ <u>\</u>	Pitch (mm)	2 /2 2 / 52 //	7 (0 7 ( 04 11 : )	2/2.5/		
İ	M6 × 1.0	6 (0.6 / 52 lb·in)	7 (0.7 / 61 lb·in)	8 (0.8 /		-
# =	M8 × 1.25	13 (1.3 / 113 lb·in)	17 (1.7 / 12)		0 / 14)	24 (2.4 / 17)
ĕ	M10 × 1.25	27 (2.8 / 20)	37 (3.8 / 27)	1	3 / 31)	50 (5.1 / 37)
ad	M12 × 1.25	61 (6.3 / 45)	76 (7.8 / 56)	1	9 / 64)	95 (9.7 / 70)
₹	M14 × 1.5	96 (9.8 / 71)	116 (11.8 / 85)	1	3.6 / 98)	142 (14.5 / 105)
×	M16 × 1.5	130 (13.3 / 96)	170 (17.3 / 125)	§	.7 / 143)	200 (20.4 / 148)
£	M18 × 1.5	188 (19.2 / 139)	244 (24.9 / 180)	278 (28		287 (29.3 / 212)
2	M20 × 1.5	258 (26.3 / 190)	337 (34.4 / 249)	385 (39		396 (40.4 / 292)
da	M22 × 1.5	332 (33.9 / 245)	453 (46.3 / 335)	517 (52		530 (54.1 / 391)
Standard Hex. Head Bolt	M24 × 2.0	449 (45.8 / 331)	570 (58.2 / 421)	651 (66		692 (70.6 / 511)
St	* M10 × 1.5	26 (2.7 / 20)	36 (3.7 / 27)	41 (4		48 (4.9 / 35)
	* M12 × 1.75	57 (5.8 / 42)	71 (7.2 / 52)	80 (8		89 (9.1 / 66)
	* M14 × 2.0	89 (9.1 / 66)	110 (11.2 / 81)		2.7 / 92)	133 (13.6 / 98)
	* M16 × 2.0	124 (12.7 / 92)	162 (16.5 / 119)	185 (18.		191 (19.5 / 141)
	M6 × 1.0	7 (0.7 / 61 lb·in)	8 (0.8 / 69 lb·in)	9 (0.9 /		~
	M8 × 1.25	15 (1.5 / 11)	19 (1.9 / 14)	22 (2	1	26 (2.7 / 20)
	M10 × 1.25	31 (3.2 / 23)	41 (4.2 / 30)	47 (4.)		56 (5.7 / 41)
	M12 × 1.25	69 (7.0 / 51)	85 (8.7 / 63)	97 (9.		106 (10.8 / 78)
l	M14 × 1.5	104 (10.6 / 77)	126 (12.8 / 93)		.6 / 106)	154 (15.7 / 114)
=	M16 × 1.5	145 (14.8 / 127)	188 (19.2 / 139)	214 (21	.8 / 158)	221 (22.5 / 163)
8	M18 × 1.5	-	-	-	-	-
) g	M20 × 1.5	-	-	-	-	-
Flange Bolt	M22 × 1.5	-	-	<del>-</del>	-	~
<u> </u>	M24 × 2.0		-	40.44	7 ( 0 4 )	54/55/40
	* M10 × 1.5	30 (3.1 / 22)	40 (4.1 / 30)	1	7 / 34)	54 (5.5 / 40)
	* M12 × 1.75	64 (6.5 / 47)	78 (8.0 / 58)	i '	1 / 66) 2 / 60 7\	99 (10.1 / 73)
	* M14 × 2.0	97 (9.9 / 72)	119 (12.1 / 88)	i -	8 / 99.7) 7 / 150)	144 (14.7 / 107)
	* M16 × 2.0	137 (14.0 / 101)	178 (18.2 / 132)	203 (20	./ / 150)	210 (21.5 / 155)

The asterisk \* indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.

## श् FL

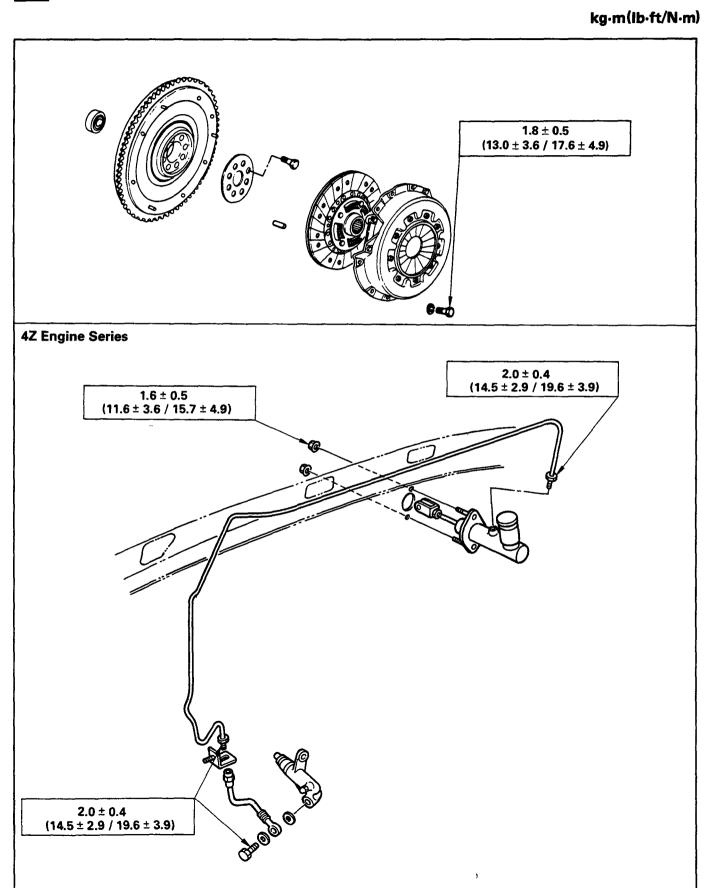
#### **FLARE NUTS**

N·m (kg·m / lb·ft)

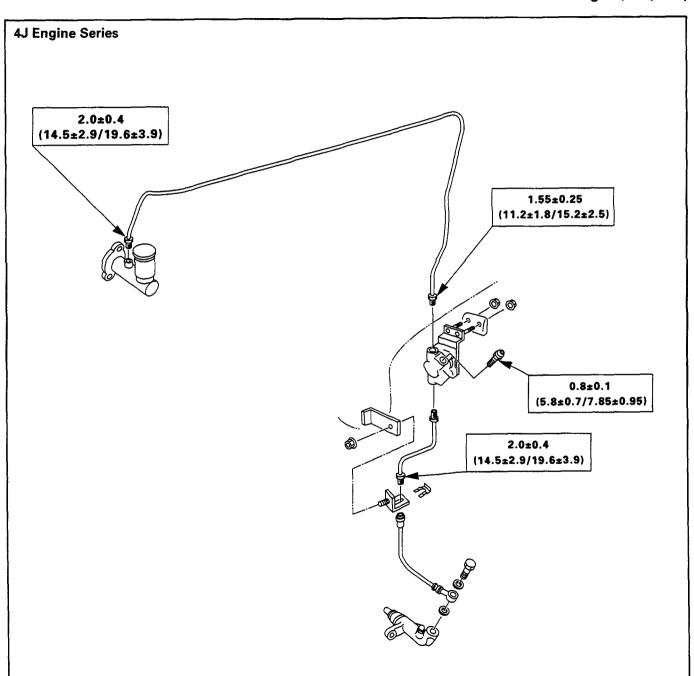
Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)



## **SPECIAL PARTS FIXING NUTS AND BOLTS**

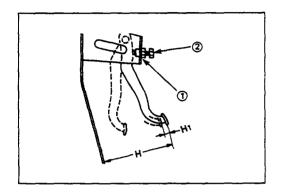


kg·m (lb-ft/N·m)



## **SERVICING**

Servicing refers to general maintenance procedures to be performed by qualified service personnel.





#### **CLUTCH PEDAL HEIGHT**

#### Inspection

Measure to verify that the distance from the upper surface of the pedal pad to the firewall is within the standard value.

Clutch Pedal Height	mm (in)
216—226	
(8.50—8.90)	

#### **Adjustment**

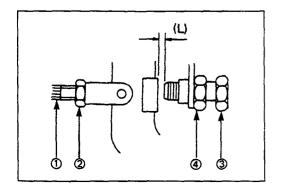
- Adjust the clutch pedal height by loosening lock nut (1) and turning stopper bolt or clutch switch (2).
- 2. After the adjustment, tighten lock nut (1).

#### **CLUTCH PEDAL PLAY**

#### Inspection

Depress the clutch pedal lightly by hand, and measure to determine if the free play is within the standard value.

Clutch Peda	l Height	mm (in)
H1	5.0—15.0	
	(0.20.6)	





#### **Clutch Pedal Play Adjustment**

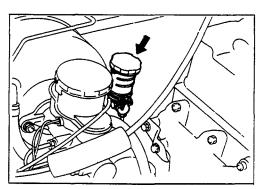
- 1. Adjust the free play by loosening lock nut (2) and turning push rod (1).
- 2. After adjustment, tighten lock nut (2).
- 3. Drive in (3) so that (L) becomes 0.5 to 1.5 mm (0.02 to 0.06 in), then lock (4).

#### **Bleeding Procedure**

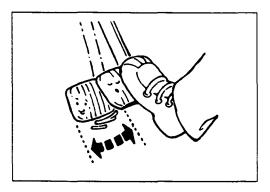
- 1. Bleed air from clutch operating cylinder according to the following procedure.
- Carefully monitor fluid level at master cylinder during bleeding operation.



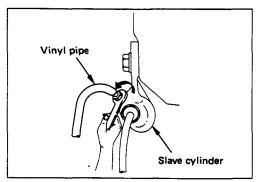
1. Set the paking brake.



- 2. Top up reservoir with recommended brake fluid.
- 3. Connect a transparent vinyl tube to air bleeder valve.



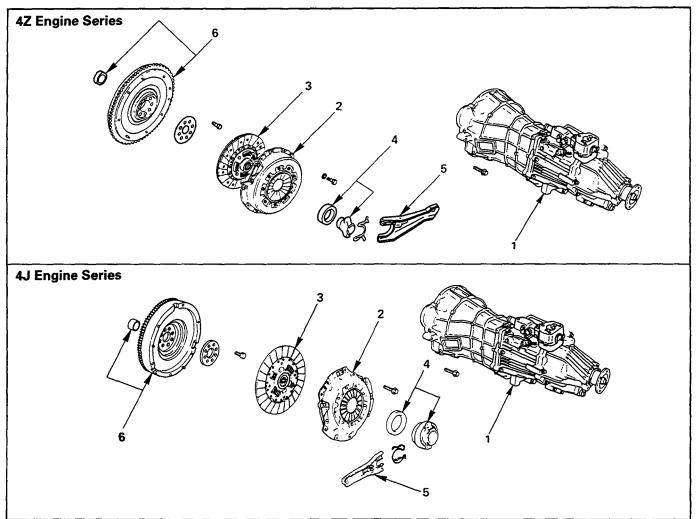
4. Fully depress clutch pedal several times.



- 5. With clutch pedal depressed, open bleeder valve to release air.
- 6. Close bleeder valve.
- 7. Repeat steps 5 through 6 above until brake fluid flows from air bleeder valve without air bubbles.
- 8. Bleed air from clutch damper according to the above procedure.
- 9. Repeat the above bleeding procedure 1 and 2 several times.

#### **CLUTCH**





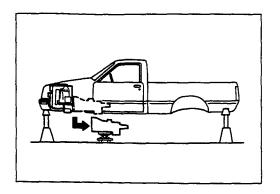
#### **Removal Steps**

- 1. Transmission assembly
- ▲ 2. Pressure plate assembly
- ▲ 3. Driven plate assembly
  - 4. Release bearing
  - 5. Shift fork

### 6. Flywheel assembly and cran bearing

#### **Installation Steps**

To install, follow the removal steps in the reverse order.

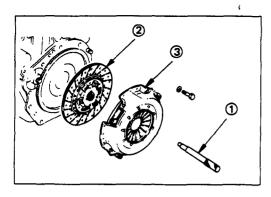




#### Important Operations — Removal

#### 1. Transmission Assembly

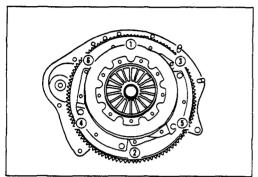
Refer to "MANUAL TRANSMISSION" of section 7B for "REMOVAL AND INSTALLATION" procedure.





- 2. Clutch Pressure Plate Assembly
- 3. Driven Plate Assembly
- 1. Use the clutch pilot aligner ① to prevent the driven plate assembly ② from falling free.

Clutch Pilot Aligner: 5-8525-3001-0 (J-24547)

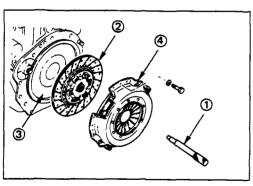


- 2. Loosen the clutch cover bolts in the numerical order shown in the illustration.
- 3. Remove the pressure plate assembly 3 from the flywheel.
- 4. Remove the driven plate from the flywheel.



#### Important Operations - Installation

Follow the removal procedure in reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



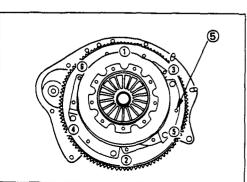


- 3. Driven Plate Assembly
- 2. Clutch Pressure Plate Assembly



- 2. Clean the facing surface.
- 3. Use the clutch pilot aligner ① to install the driven plate assembly ② to the flywheel ③.

Clutch Pilot Aligner: 5-8525-3001-0 (J-24547)





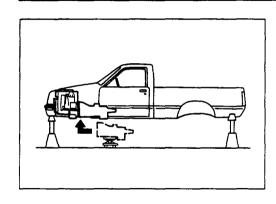


- 4. Clean the pressure plate surfaces.
- 5. Align the pressure plate assembly 4 with the flywheel knock pin 5.
- 6. Install the pressure plate assembly to the flywheel.
- 7. Tighten the clutch cover bolts a little at a time in the numerical order shown in the illustration.

Clutch Cover Bolt Torque kg·m(lb.ft/N·m)

 $1.8 \pm 0.5 (13.0 \pm 3.6/17.6 \pm 4.9)$ 

#### 7C-14 CLUTCH



8. Remove the clutch pilot aligner.

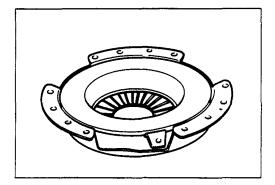
#### Note:

Do not strike the clutch pilot aligner with a hammer to remove it.



#### **INSPECTION AND REPAIR**

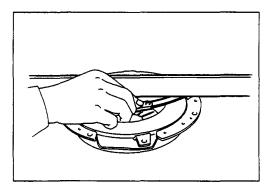
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



#### PRESSURE PLATE ASSEMBLY

Visually inspect the pressure plate friction surface for excessive wear and heat cracks.

If excessive wear or deep heat cracks are present, the pressure plate must be replaced.



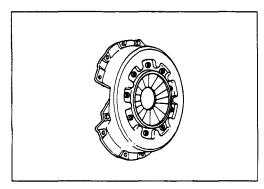


#### **Pressure Plate Warpage**

Use a straight edge and a feeler gauge to measure the pressure plate friction surface flatness in four directions.

If any of the measured values exceed the specified limit, the pressure plate must be replaced.

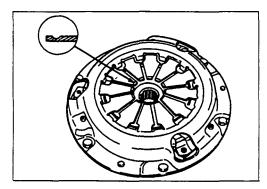
Pressure Plate Warpage	mm(in)
Limit	
0.3 (0.012)	



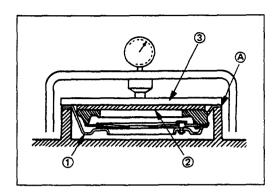
#### **Clutch Cover**

Visually inspect the entire clutch cover for excessive wear, cracking, and other damage.

The clutch cover must be replaced if any of these conditions are present.



- 1. Abrasion, scratches, cracks and deflection of friction face to the disc, loose rivet and wear of wire ring
  - Grind small scratches, or replace the assembly if extreme scratches are found.





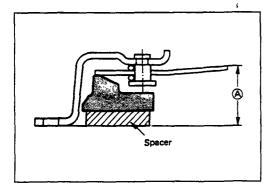
#### **Clutch Set Force**

- 1. Position the pressure plate assembly (1) as shown in the illustration.
- 2. Place the new driven plate (2) over the pressure plate assembly.

Driven Plate Thick	(ness (Reference)	mm (in)	
	Standard		
	Free	Compressed	
4ZC1	8.0 (0.315)	7.8 (0.307)	
4ZE1	8.2 (0.323)	8.0 (0.315)	
4JA1	8.0 (0.315)	7.8 (0.307)	
4JB1T	8.0 (0.315)	7.8 (0.307)	

- 3. Place a metal sheet (3) between the press and the driving plate.
- Compress the metal sheet and the driven plate until the driven plate is flush with the drive plate assembly (A).
- 5. Note the pressure gauge reading.

Driven Plate Slamping	Force kg (Lb/N)
	Standard
4ZC1	486 (1,072/4,766)
4JA1	500 (1,103/4,903)
4ZE1	560 (1,235/5,492)
4JB1T	560 (1,235/5,492)





#### Diaphragm Spring Finger Height

1. Place the appropriate spacer beneath the pressure plate.

Refer to the table below

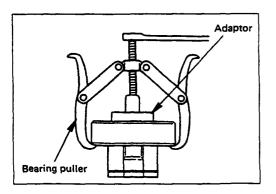
Spacer Thickness (Refer	rence) mm (in)
4ZE1	8.0 (0.315)
OTHER	7.8 (0.307)

2. Fully compress the pressure plate and the diaphragm spring.

There are two ways to do this.

- 1) Use a bench press to press down the assembly from the top.
- 2) Tighten the fixing bolts.
- 3. Measure the spring finger height (A) from the base to the spring tip.

Spring Finger Height	mm (in)
4ZC1	31.7 — 33.7 (1.25 — 1.33)
4JA1	30.5 — 32.5 (1.20 — 1.28)
4ZE1	37.5 — 39.5 (1.48 — 1.56)
4JB1T	35.0 — 37.0 (1.38 — 1.46)

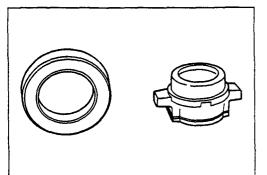




## Release Bearing Replacement Removal

Use the bearing puller and the adapter to remove the release bearing.

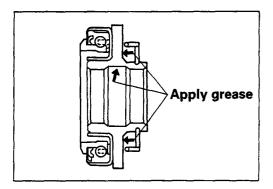
Bearing Puller : 5-8840-0013-0 (J-22888) Adapter : 5-8840-0124-0 (J-2241-11)



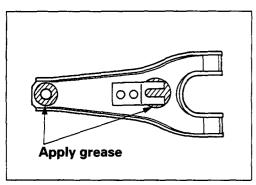


#### Release Bearing Installation

- 1. Set the release bearing to the shift block bearing fitting surfaces.
- 2. Use a bench press to fit the release bearing to the shift block.

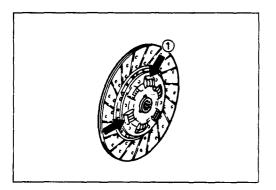


Install the parts as illustrated after applying wheel bearing grease or multi-purpose type grease (NLGI No. 2 or No. 3).



#### Shift Fork

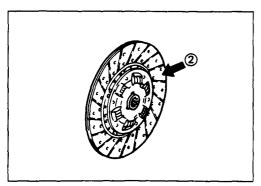
- Visually inspect the surfaces of the shift fork making contact with the shift block for excessive wear and damage.
- 2. Remove any minor stepping or abrasion from the shift block with an oil stone.
  - Replace any exhibiting excessive wear or damage.
- 3. Apply multi-purpose type grease (NLGI No.2 or No.3) to make area.



#### DRIVEN PLATE ASSEMBLY

1. Visually inspect the torsion spring ① for looseness, breakage, and weakening.

If any of these conditions are discovered, the driven plate assembly must be replaced.



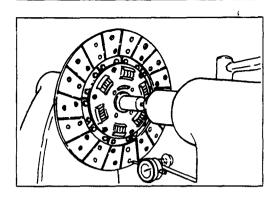
2. Visually inspect the facing surfaces ② for cracking and excessive scorching.

Visually inspect the facing surfaces for the presence of oil or grease.

If any of these conditions are discovered, the facing must be cleaned or replaced.

3. Check that the driven plate moves smoothly on the transmission top gear shaft spline.

Minor ridges on the top gear shaft spline may be removed with an oil stone.





#### Driven Plate Warpage

 Insert the clutch pilot aligner into the driven plate splined hub.

The clutch pilot aligner must be held perfectly horizontal.

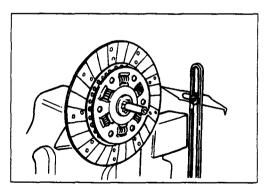
Clutch Pilot Aligner: 5-8825-3001-0 (J-24547)

- 2. Set a dial indicator to the driven plate outside circumference.
- 3. Slowly turn the driven plate.

Read the dial indicator as you turn the driven plate.

If the measured value exceeds the specified limit, the driven plate assembly and/or the facing must be replaced.

mm(in	
Limit	
1.0 (0.039)	







#### **Driven Plate Splined Hub Spline Wear**

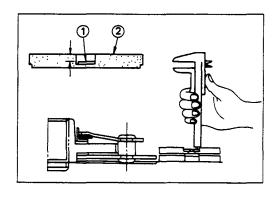
- 1. Clean the driven plate splined hub.
- 2. Install the driven plate to the transmission top gear shaft spline.
- 3. Set a surface gauge to the driven plate outside circumference.
- 4. Slowly turn the driven plate counterclockwise.

Measure the spline rotation play as you turn the driven plate.

If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Splined Hub Spl	line Wear mm(in)	
Standard	Limit	
0.5 (0.020)	1.0 (0.039)	

#### 7C-20 CLUTCH





#### **Rivet Head Depression**

Use a depth gauge or a straight edge with steel rule to measure the rivet head depression ① from the facing surface ②.

Be sure to measure the rivet head depression on both sides of the driven plate.

If the measured value is less than the specified limit, the facing must be replaced.

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mm(in)

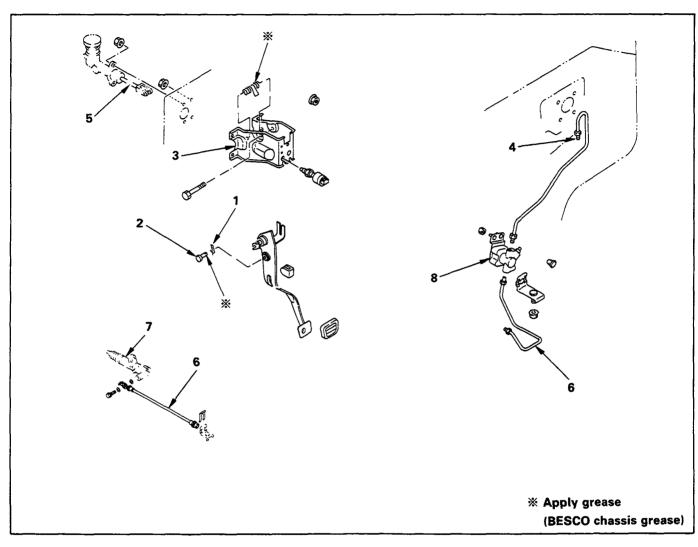
	Standard		Limit	
	Fly wheel side	P/Plate side	Littill	
4JA1	1.35—1.95 (0.053—0.077)	1.65—2.25 (0.065—0.089)	0.2	
OTHER	1.3—1.9 (0.051—0.075)		(800.0)	

#### **CLUTCH CONTROL**





#### **REMOVAL AND INSTALLATION**



#### **Removal Steps**

- 1. Pin
- 2. Jaw joint pin
- 3. Pedal assembly
- 4. Oil line
- 5. Master cylinder assembly
- 6. Oil line
- 7. Slave cylinder assembly
- 8. Damper cylinder assembly (For 4J engine series)

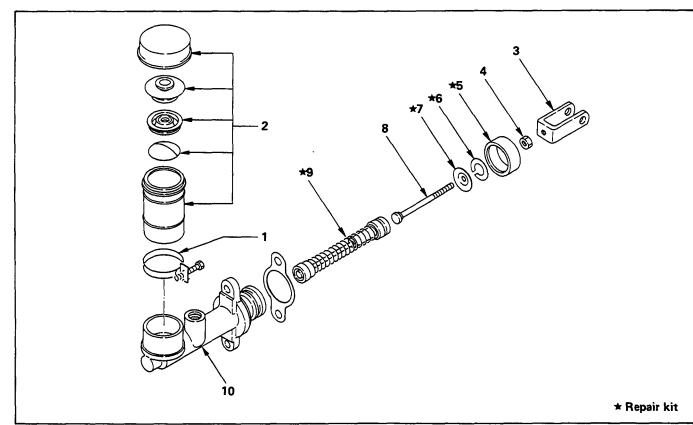
#### **Installation Steps**

- 8. Damper cylinder assembly (For 4J engine series)
- 7. Slave cylinder assembly
- 6. Oil line
- 5. Master cylinder assembly
- 4. Oil line
- 3. Pedal assembly 2. Jaw joint pin
- 1. Pin

#### **MASTER CYLINDER**



#### **DISASSEMBLY**



#### **Disassembly Steps**

- 1. Oil tank band 2. Oil tank assembly
- 3. Joint
- 4. Lock nut 5. Dust cover

- 6. Stopper ring 7. Stopper
- 8. Push rod
- 9. Piston assembly
- 10. Cylinder body



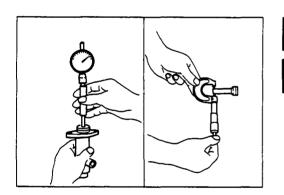
#### **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



#### **Cylinder Body**

- 1. Clean the cylinder body.
- 2. Check the fluid return port for restrictions and clean it if necessary.



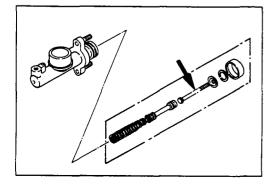


#### **Cylinder Bore and Piston Clearance**

- 1. Clean the cylinder body and the piston.
- 2. Use an inside dial indicator to measure the cylinder bore.
- 3. Use a micrometer to measure the piston diameter.
- 4. Calculate the clearance between the cylinder bore and the piston.

If the clearance exceeds the limit, the entire master cylinder assembly must be replaced.

Cylinder Bore and Piston Clea	rance mm(in)
Standard	Limit
0.07 (0.0028)	0.15 (0.006)

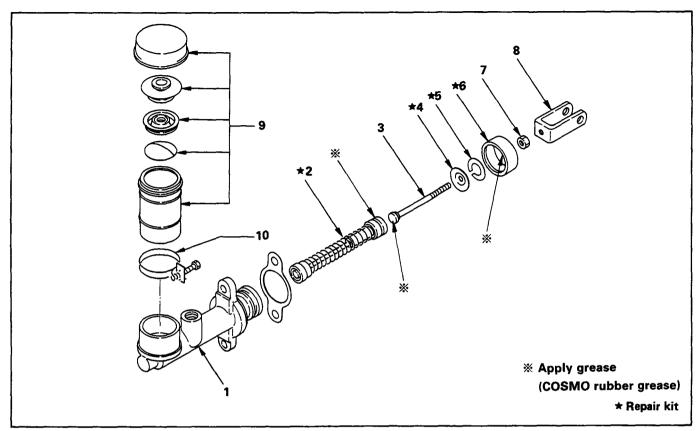


#### **Inner Parts**

Replace the inner parts with new parts shown in the illustration.



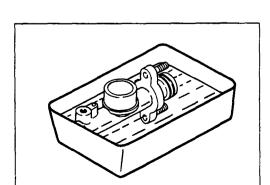
#### **REASSEMBLY**



#### **Reassembly Steps**

- ▲ 1. Cylinder body
  - 2. Piston assembly
  - 3. Push rod
  - 4 Stopper
  - 5. Stopper ring

- 6. Dust cover
- 7. Lock nut
- 8. Joint
- 9. Oil tank assembly
- 10. Oil tank band





#### **Important Operations**

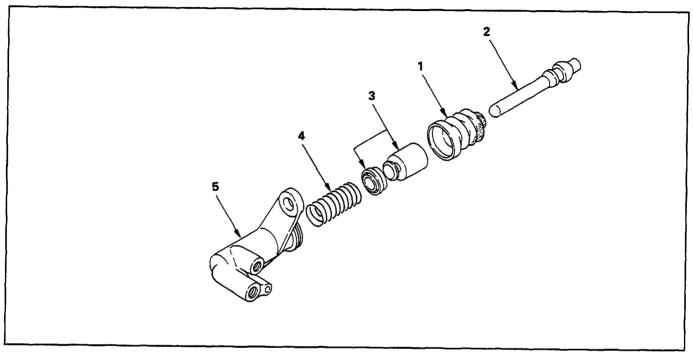


#### 1. Cylinder Body

Immerse the cylinder body in clean brake fluid.

#### **SLAVE CYLINDER**

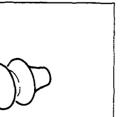




#### **Disassembly Steps**

- ▲ 1. Boot
  - 2. Push rod
  - 3. Piston and piston cup

- 4. Spring
- 5. Cylinder body
- 6. Solenoid switch





#### **Important Operations**

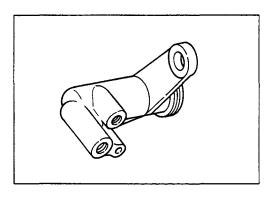
#### 1. Boot

Brake fluid spilled on painted or plastic surfaces will cause serious damage. Take care not to spill brake fluid.



#### **INSPECTION AND REPAIR**

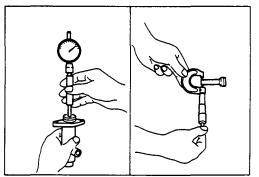
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.





#### Cylinder Body

- 1. Clean the cylinder body.
- 2. Check the fluid return port for restrictions and clean it if necessary.



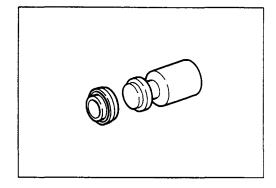


#### Cylinder Bore and Piston Clearance

- 1. Clean the cylinder body and the piston.
- Use an inside dial indicator to measure the cylinder bore.
- 3. Use a micrometer to measure the piston diameter.
- 4. Calculate the clearance between the cylinder bore and the piston diameter.

If the clearance exceeds the limit, the entire slave cylinder assembly must be replaced.

Cylinder Bore and Piston Clea	arance mm(in)
Standard	Limit
0.07 (0.0028)	0.15 (0.006)

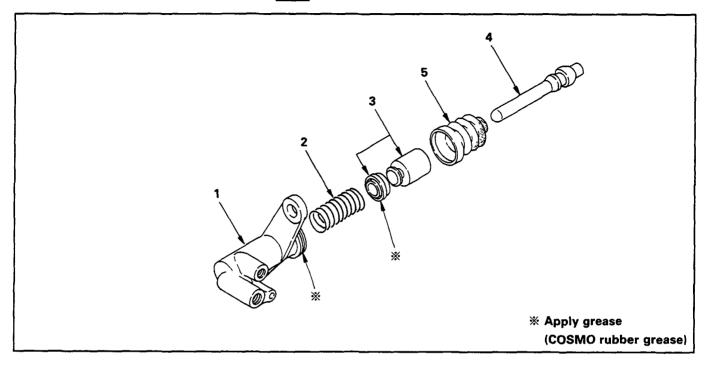


#### **Piston and Piston Cup**

Visually inspect the disassembled piston and piston cup for excessive wear and damage.

Replace the inner parts with new parts (Repair Kit A) shown in the illustration.

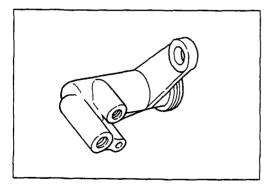
# REASSEMBLY



#### **Reassembly Steps**

- ▲ 1. Cylinder body
  - 2. Spring
- ▲ 3. Piston and piston cup

- 4. Push rod
- 5. Boot
- 6. Solenoid switch





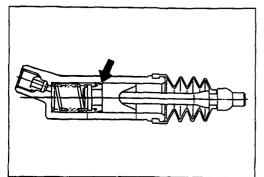
#### **Important Operations**



- 1. Cylinder Body
- 1) Clean the cylinder body.



2) Apply brake fluid to the cylinder bore.





- 3. Piston and Piston Cup
- 1) Apply brake fluid to the piston and piston cup.



- 2) Install the cups to the piston.
  - Note the installation direction of the piston cups in the illustration.
- 3) Install the piston and piston cup to the cylinder body.

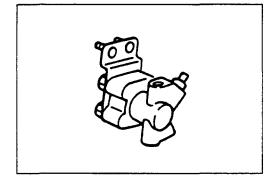
#### HYDRAULIC DAMPER CYLINDER

(For 4J Engine Models)



#### **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



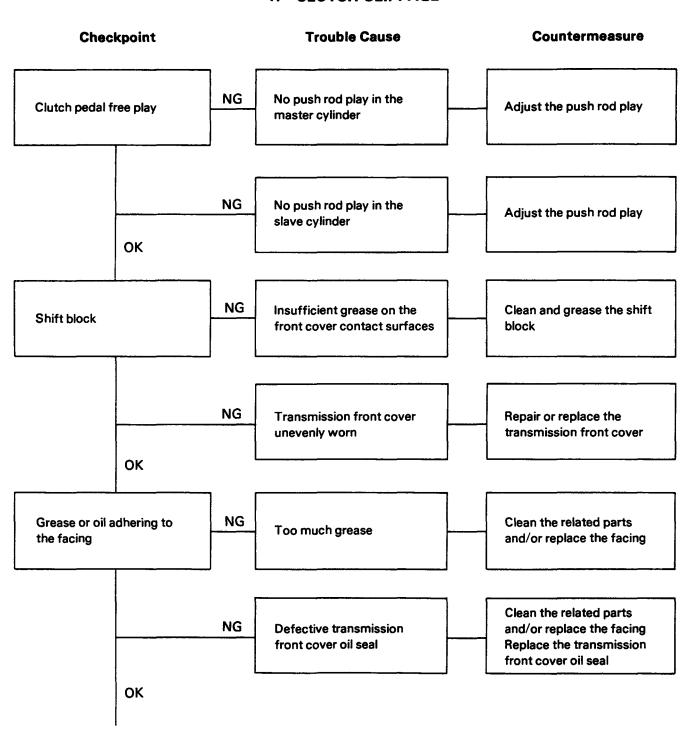
Visually check for oil leakage and other damage. If oil leakage or other damage is discovered during the inspection; the damper cylinder assembly must be replaced as a unit.

#### TROUBLESHOOTING

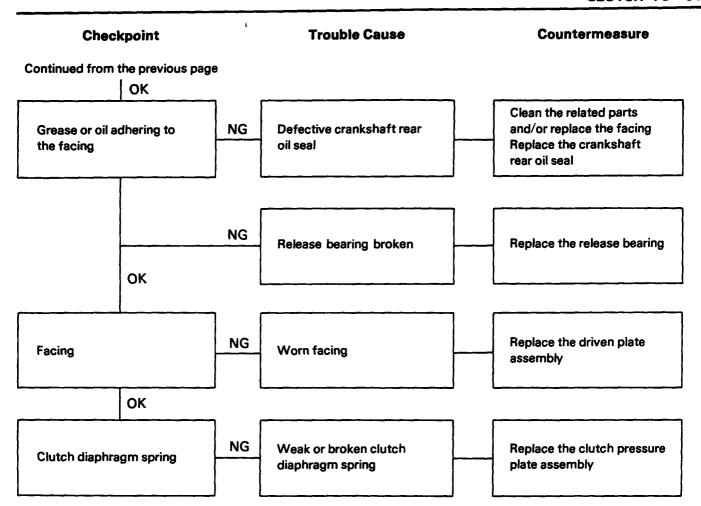
Refer to this Section to quickly diagnose and repair clutch problems. Each troubleshooting chart has three headings arranged from left to right.

- (1) Checkpoint (2) Trouble Cause (3) Countermeasure
- This Section is divided into five sub-sections:
  - 1. Clutch Slippage
  - 2. Clutch Does Not Release Properly
  - 3. Clutch Shudder
  - 4. Clutch Noise
    - 1) Clutch Pedal Depressed (Clutch Disengaged)
    - 2) Clutch Pedal Not Depressed (Clutch Engaged)
  - 5. Oil Leakage

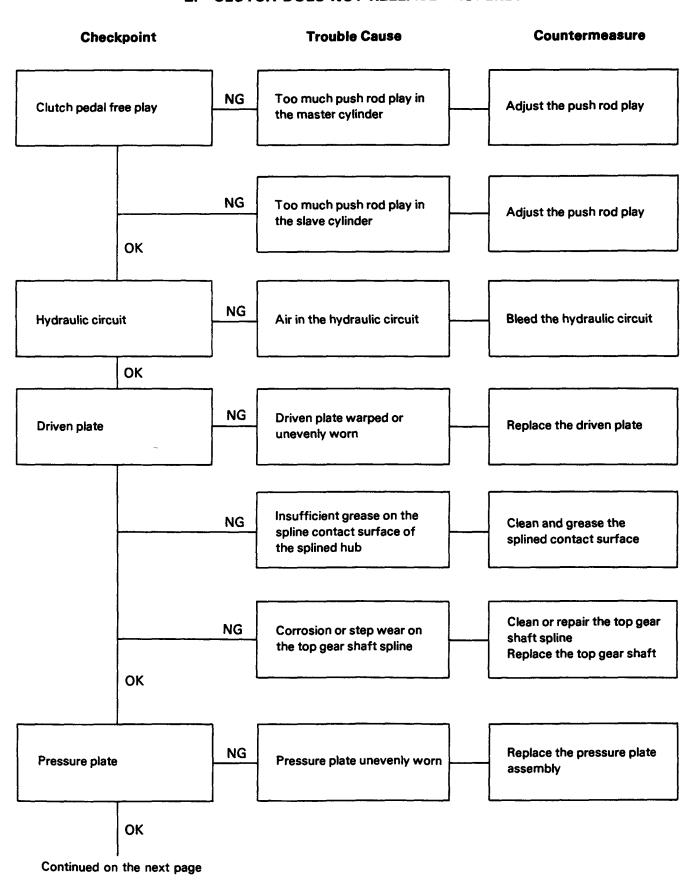
#### 1. CLUTCH SLIPPAGE



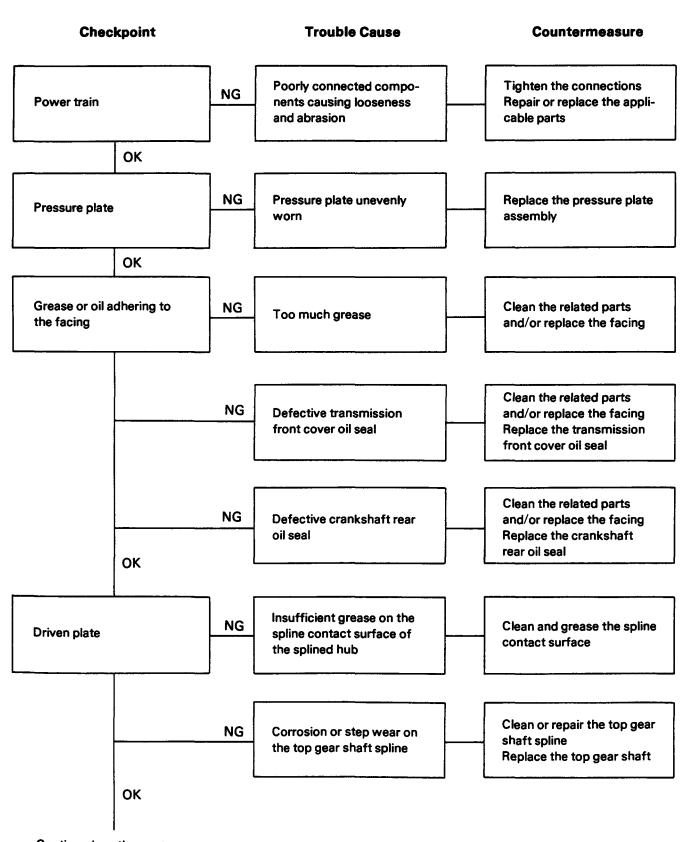
Continued on the next page



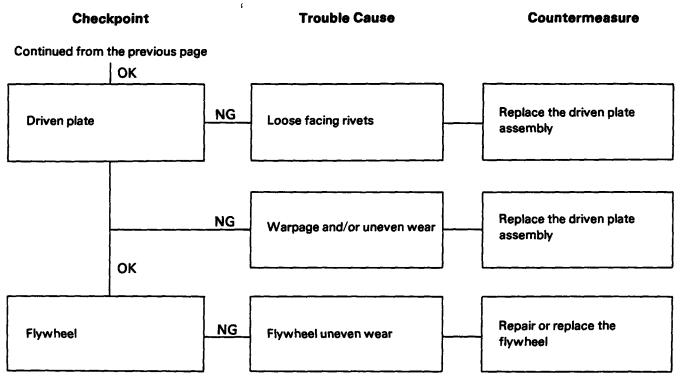
#### 2. CLUTCH DOES NOT RELEASE PROPERLY



#### 3. CLUTCH SHUDDER

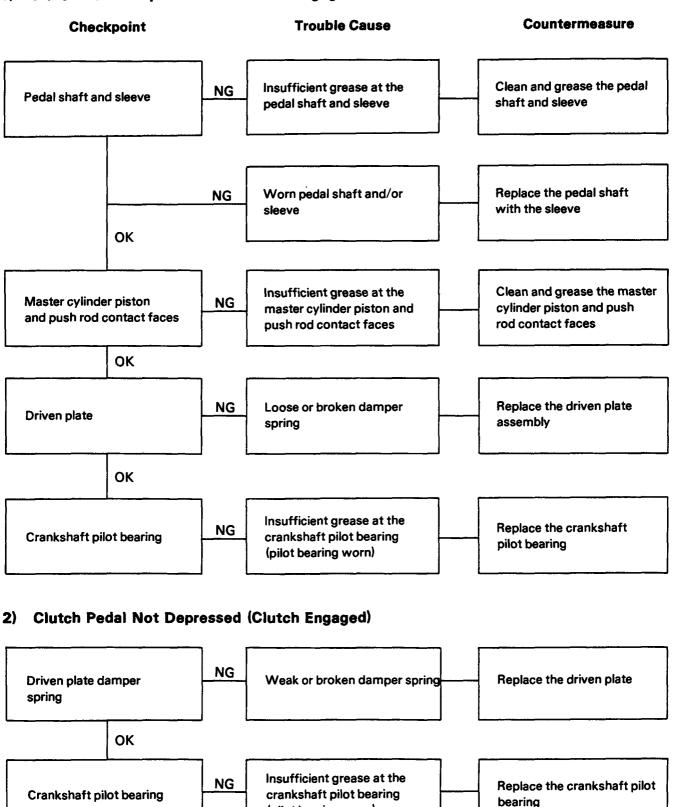


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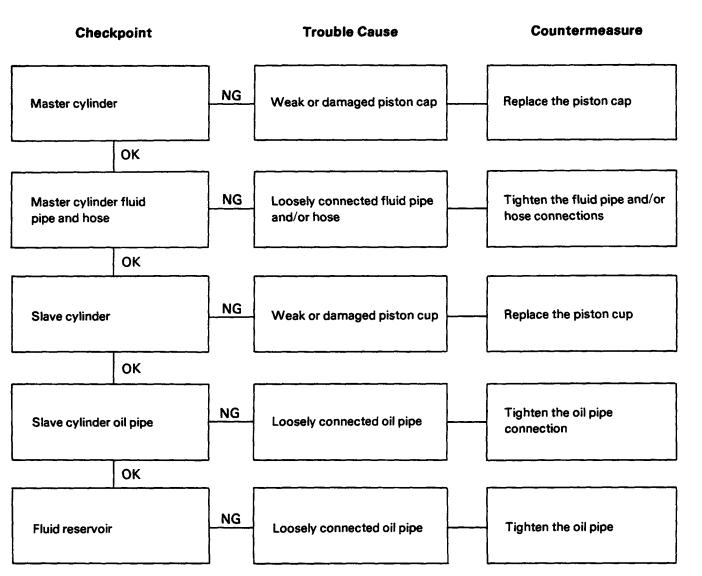
#### 4. CLUTCH NOISE

#### 1) Clutch Pedal Depressed (Clutch Disengaged)



(pilot bearing worn)

#### 5. OIL LEAKAGE

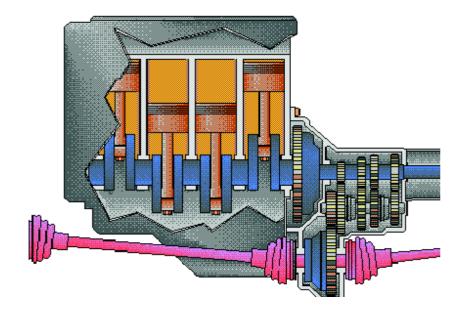






4 x 2

4 x 4



# KB TF 140 MUA Gearbox

# SECTION 7B1 MANUAL TRANSMISSION

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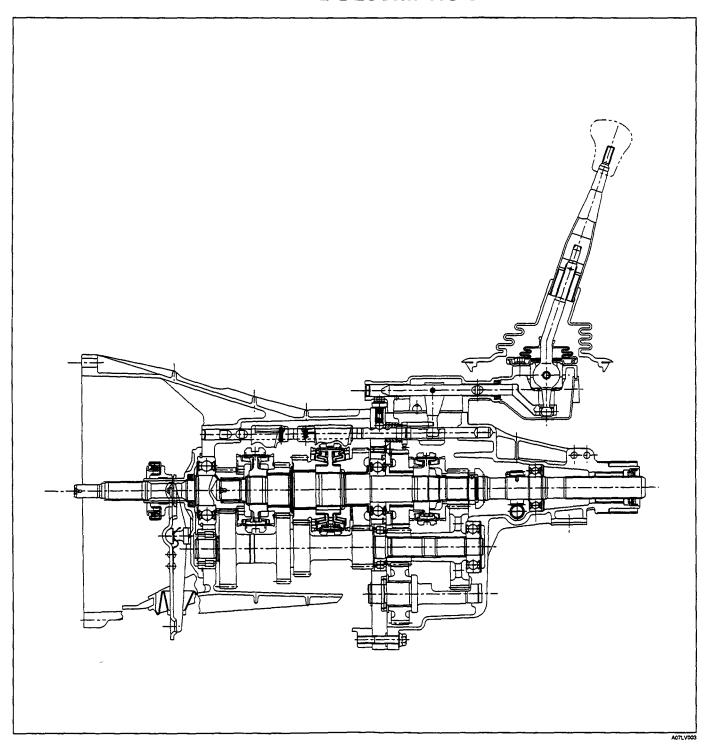
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#### 4 x 2 MODEL TRANSMISSION

#### MAIN DATA AND SPECIFICATIONS

Models		MUA 5C	MUA 5S	
Transmission type		Fully synchronized 5-forward and revers gears.		
Gear ratio	1st	3.767	4.357	
	2nd	2.248	2.502	
	3rd	1.404	1.501	
	4th	1.000	1.000	
	5th	0.809	0.809	
i	Rev.	3.875	3.970	
Oil capacity	lit (US gal.)	2.95 (0.78)		

#### **GENERAL DESCRIPTION**



The transmission is designed for the quietest possible operation.

A longer center distance (77.5 mm (3.05 in)) provides increased durability.

Principle parts of the transmission are the integral clutch housing, the intermediate plate, the rear cover, and the gears.

The gear control box is built-in to the rear cover.

#### **TORQUE SPECIFICATIONS**

#### STANDARD BOLTS

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m / lb-ft)

	Strength	1 10/11   10/01				
	Class			Refined	Non-Refined	-
	Bolt Identifi- cation	4	$\bigcirc$	8	8	9
	Bolt Diameterx Pitch (mm)	No mark				
Bolt	M6 × 1.0 M8 × 1.25 M10 × 1.25	6 (0.6 / 52 lb-in) 13 (1.3 / 113 lb-in) 27 (2.8 / 20)	7 (0.7 / 61 lb·in) 17 (1.7 / 12) 37 (3.8 / 27)	20 (2.	69 lb-in) 0 / 14) 3 / 31)	24 (2.4 / 17) 50 (5.1 / 37)
c. Head	M12 × 1.25 M14 × 1.5 M16 × 1.5	61 (6.3 / 45) 96 (9.8 / 71) 130 (13.3 / 96)	76 (7.8 / 56) 116 (11.8 / 85) 170 (17.3 / 125)	133 (13	9 / 64) 3.6 / 98) .7 / 143)	95 (9.7 / 70) 142 (14.5 / 105) 200 (20.4 / 148)
Standard Hex. Head Bolt	M18 × 1.5 M20 × 1.5 M22 × 1.5	188 (19.2 / 139) 258 (26.3 / 190) 332 (33.9 / 245)	244 (24.9 / 180) 337 (34.4 / 249) 453 (46.3 / 335)	385 (39	.3 / 205) .3 / 284) .7 / 381)	287 (29.3 / 212) 396 (40.4 / 292) 530 (54.1 / 391)
Stanc	M24 × 2.0 * M10 × 1.5 * M12 × 1.75	449 (45.8 / 331) 26 (2.7 / 20) 57 (5.8 / 42)	570 (58.2 / 421) 36 (3.7 / 27) 71 (7.2 / 52)	41 (4. 80 (8.	.3 / 480) 2 / 30) 2 / 59)	692 (70.6 / 511) 48 (4.9 / 35) 89 (9.1 / 66)
	* M14 × 2.0 * M16 × 2.0 M6 × 1.0	89 (9.1 / 66) 124 (12.7 / 92) 7 (0.7 / 61 lb·in)	110 (11.2 / 81) 162 (16.5 / 119) 8 (0.8 / 69 lb·in)		2.7 / 92) .9 / 137) 78 (b.in)	133 (13.6 / 98) 191 (19.5 / 141)
	M8 × 1.25 M10 × 1.25 M12 × 1.25	15 (1.5 / 11) 31 (3.2 / 23) 69 (7.0 / 51)	19 (1.9 / 14) 41 (4.2 / 30) 85 (8.7 / 63)	22 (2	2 / 16) 8 / 35)	26 (2.7 / 20) 56 (5.7 / 41) 106 (10.8 / 78)
olt	M14 × 1.5 M16 × 1.5	104 (10.6 / 77) 145 (14.8 / 127)	126 (12.8 / 93) 188 (19.2 / 139)		.6 / 106)	154 (15.7 / 114) 221 (22.5 / 163)
Flange Bolt	M18 × 1.5 M20 × 1.5 M22 × 1.5	- - -	- - -	-	<del>-</del> -	- - -
Œ	M24 × 2.0 * M10 × 1.5 * M12 × 1.75	- 30 (3.1 / 22) 64 (6.5 / 47)	- 40 (4.1 / 30) 78 (8.0 / 58)	46 (4. 89 (9.	1 / 66)	54 (5.5 / 40) 99 (10.1 / 73)
	* M14 × 2.0 * M16 × 2.0	97 (9.9 / 72) 137 (14.0 / 101)	119 (12.1 / 88) 178 (18.2 / 132)	135 (13. 203 (20.	8 / 99.7) .7 / 150)	144 (14.7 / 107) 210 (21.5 / 155)

The asterisk \* indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.

#### হ্ম FLARE NUTS

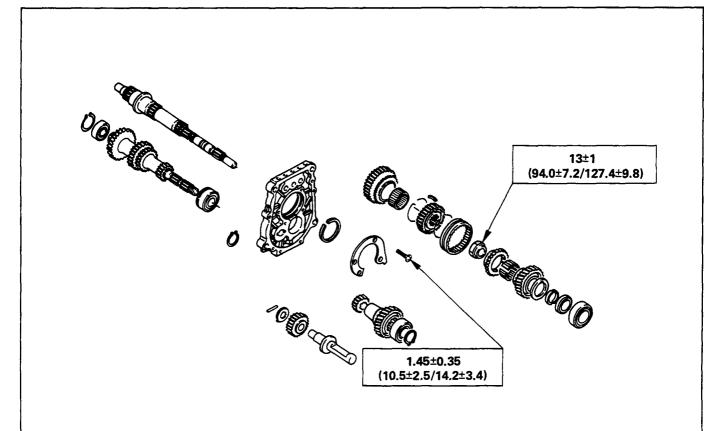
N·m (kg·m / lb·ft)

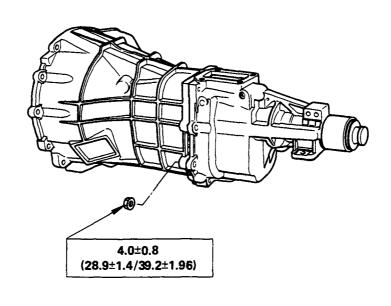
Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)



#### **SPECIAL PARTS FIXING NUTS AND BOLTS**

kg·m(lb.ft/N·m)







#### RECOMMENDED LIQUID GASKET

Туре	Brand Name	Manufacturer	Remarks	
RTV*	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	For Engine Repairs	
Silicon Base	ThreeBond 1215 ThreeBond 1281	Three Bond Three Bond	For Axle Case and Transmission Repairs	
Water Base	ThreeBond 1141E	Three Bond	For Engine Repairs	
Solvent	ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs	
Anerobic LOCTITE 515 LOCTITE 518		Loctite Loctite	All	

<sup>\*</sup> RTV: Room Temperature Vulcanizer

#### Note:

- 1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
- 2. Be careful to use the specified amount of liquid gasket. Follow the manufacturer's instructions at all times.
- 3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.
  - The connecting surfaces must be perfectly dry.
- 4. LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.

  Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.





#### **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



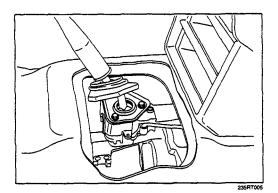
#### Important Operations - Removal

#### **Battery Cable**

Disconnect the negative (-) cable from the battery terminal.

#### **Engine Hood**

Apply setting marks to the engine hood and the engine hood hinges before removing the engine hood.



#### **Gear Shift Lever**

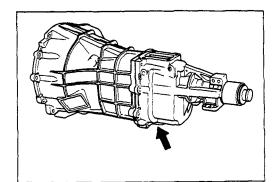
- 1. Place the gear shift lever in the neutral position.
- 2. Remove the gear shift lever knob.
- Remove the front console assembly.
- 4. Remove the gear shift lever grommet and dust cover.
- 5. Remove the gear shift lever cover bolts.
- 6. Remove the gear shift lever.

#### Note:

Cover the shift lever hole to prevent the entry of foreign material into the transmission.

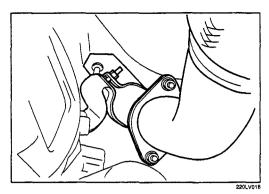
#### Lifting the Vehicle

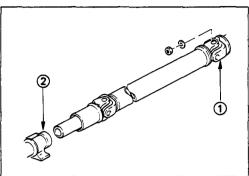
- 1. Jack up the vehicle.
- 2. Place chassis stands at the front and the rear of the vehicle.

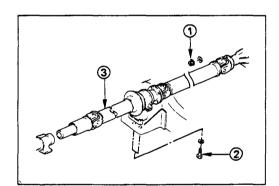


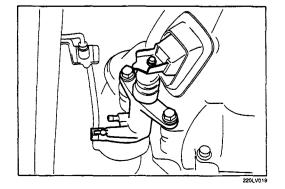
#### **Transmission Oil Draining**

- 1. Remove the transmission oil drain plug.
- 2. Replace the drain plug after draining the oil.









#### **Exhaust Pipe**

- 1. Remove the exhaust pipe bracket from the transmission case.
- 2. Remove the front exhaust pipe and 2nd-3rd exhaust pipe.

#### Rear Propeller Shaft (Single Shaft Type)

- 1. Remove the propeller shaft flange yoke at the drive pinion side (1).
- 2. Remove the propeller shaft from the transmission main shaft spline ②.

#### Rear Prppeller Shaft (Dual Shaft Type)

- 1. Apply setting marks to the 2nd propeller shaft flange yoke.
  - This will prevent mispositioning during the installation procedure.
- 2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
- 3. Remove the center bearing retainer bolts 2.
- 4. Remove the 1st propeller shaft ③ with the center bearing and the 2nd propeller shaft. Pull the 1st propeller shaft toward the rear of the vehicle unit the spline yoke is free of the transmission main shaft.

#### **Harness Connector**

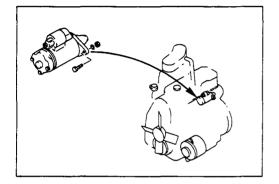
Disconnect the back up light switch connector and the speedometer sensor connector.

#### Slave Cylinder

Remove the slave cylinder from the transmission case.

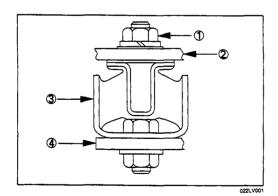
#### **Engine Lifting Hanger**

- 1. Attach the engine lifting hanger to the front portion of the engine.
- 2. Attach the lifting wire to both ends of the engine lifting hanger.



#### **Starter Motor**

Remove the starter motor from the engine rear plate.



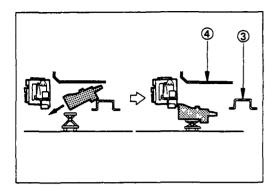
#### **Transmission**

- 1. Support the transmission with a transmission jack.
- 2. Remove the engine rear mounting rubber nuts 1 from the transmission 2.
- 3. Remove the rear mounting rubber ③ from the No.3 crossmember ④.
- 4. Remove the gear control box from the transmission.
- 5. Remove the transmission from the engine.

The removal of the transmission will require the cooperative efforts of two mechanics.

- 1) Remove the transmission nuts and bolts ① from the engine rear plate.
- 2) Place a transmission jack ② beneath the transmission.

Do not raise the transmission jack.



- 3) Manually move the transmission as far as possible toward the rear of the vehicle (into the space between the No.3 crossmember ③ and the floor panel ④.
- 4) Lower the clutch housing end of the transmission toward the transmission jack.

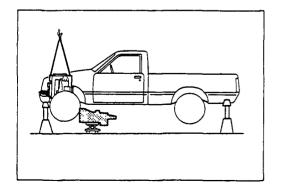
The rear of the transmission is supported by the No. 3 crossmember at this time.

5) Firmly grasp the transmission rear cover (1st mechanic).

Raise the transmission jack toward the transmission (2nd mechanic).

Carefully lower the transmission onto the transmission jack.

The transmission must be centered on the transmission jack.

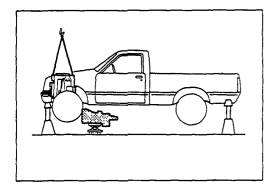


6. Carefully pull the transmission jack with the transmission from beneath the vehicle.



#### Important Operations - Installation

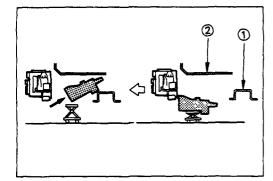
Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



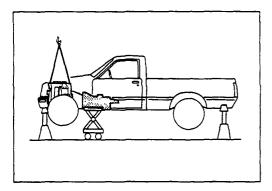


#### **Transmission**

- 1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Place the transmission on a transmission jack.
- 3. Carefully move the transmission jack and transmission into position behind the engine.



- 4. Slowly operate the transmission jack to raise the transmission until the rear of the transmission is at the same level as the No.3 crossmember (1).
- Manually support the transmission rear cover.
   Move the transmission into position between the No.3 crossmember and the floor panel ②.





6. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

The slope of the engine and the transmission must be the same.

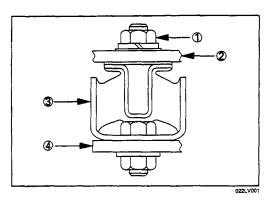
- 7. Install the gear control box to the transmission.
- 8. Align the top gear shaft spline with the clutch drive plate spline.
- 9. Install the transmission to the engine.

Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque kg·m(lb·ft/N·m)

M10:  $4.1 \pm 1.0 (30 \pm 7.2/40 \pm 10)$ 

M12:  $8.0 \pm 1.6$  (58  $\pm$  12/78  $\pm$  16)

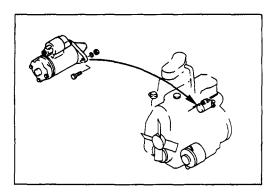




- Install the rear mounting rubber 3 to the transmission 2.
   Install the rear mounting rubber 3 to the No.3 crossmember 4.
- 11. Tighten the rear mounting rubber nuts ① to the specified torque.

Rear Mounting Rubber Nut Torque kg·m(lb·ft/N·m)  $4.2 \pm 0.5 (30 \pm 3.6/41 \pm 4.9)$ 

Mounting Bolt Torque kg·m(lb·ft/N·m)  $4.2 \pm 0.5 (30 \pm 3.6/41 \pm 4.9)$ 

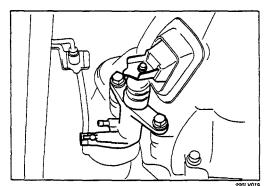




#### Starter Motor

- 1. Install the starter motor to the engine rear plate.
- Tighten the starter motor bolts to the specified torque.

Starter Motor Bolt Torque kg·m(lb·ft/N·m)  $8.0 \pm 1.6 (58 \pm 12/78 \pm 16)$ 





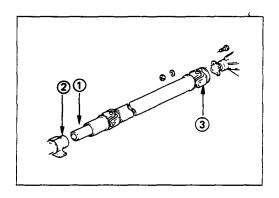
#### Slave Cylinder

Install the slave cylinder to the transmission case.

Slave Cylinder Bolt Torque kg·m(lb·ft/N·m)  $8.0 \pm 1.6 (58 \pm 12/78 \pm 16)$ 

#### **Harness Connector**

Connect the back up light switch connector and speedometer sensor connector.





#### Rear Propeller Shaft (Single Shaft Type)

- 1. Insert the splined yoke 1 with the propeller shaft into the transmission main shaft spline 2.
- 2. Install the propeller shaft flange yoke 3 to the drive pinion side.
- 3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque kg·m(lb·ft/N·m)  $6.4 \pm 0.4 (46.3 \pm 2.9/62.7 \pm 3.9)$ 



#### Rear Propeller Shaft (Dual Shaft Type)

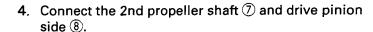
- 1. Place the center bearing and retainer (1) together with the 1st propeller shaft 2 and 2nd propeller shaft (7) on the No.4 crossmember (3).
- 2. Insert the splined yoke 4 into the transmission main shaft spline (5).
- 3. Tighten the center bearing retainer bolts 6 to the specified torque.

Center Bearing Retainer Bolt Torque  $kg \cdot m(lb \cdot ft/N \cdot m)$ 

 $6.2 \pm 1.2 (44.8 \pm 8.7/60.8 \pm 11.8)$ 







Be sure to align the setting marks applied at disassembly.

5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt

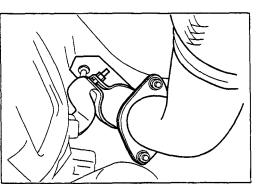
Torque

 $kg \cdot m(lb \cdot ft/N \cdot m)$ 

 $6.4 \pm 0.4 (46.3 \pm 2.9/62.7 \pm 3.9)$ 

#### **Exhaust Pipe**

- 1. Install the front exhaust pipe and 2nd-3rd exhaust pipe.
- 2. Install the exhaust pipe bracket to the transmission case.





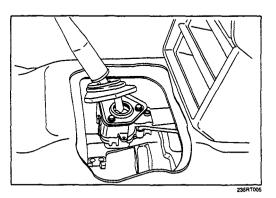
#### **Gear Shift Lever**

1. Replenish the transmission case with the specified engine oil.

Transmission Case Oil

lit(US/UK gt.)

2.95 (3.12/2.6)





- 2. Install the gear shift lever to the gear control box.
- 3. Tighten the gear shift lever cover bolts to the specified torque.

Shift Lever Cover Bolt Torque

kg·m(lb·ft/N·m)

 $2.0 \pm 0.2$  (14.5 ± 1.5/19.6 ± 1.96)

- 4. Install the dust cover and the grommet.
- 5 Install the front console assembly.
- 6. Install the gear shift lever knob.

#### Lowering the Vehicle

- 1. Place a jack beneath the vehicle.
- 2. Raise the jack to remove the chassis stands.
- 3. Lower the vehicle to the ground.

#### **Engine Hood**

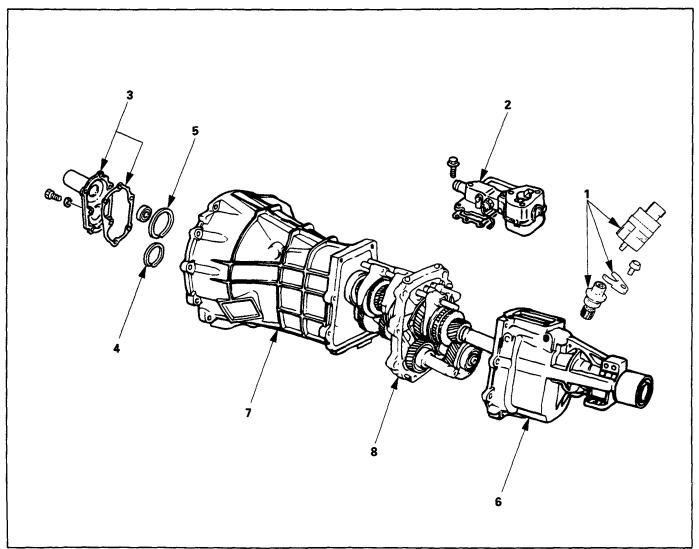
Align the setting marks (applied at removal) on the engine hood and the engine hood hinges to install the engine hood.

#### **Battery Cable**

Connect the negative (-) cable to the battery terminal.

# DISASSEMBLY

### **MAJOR COMPONENTS**

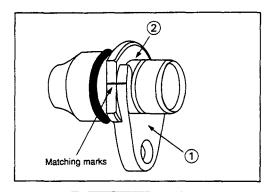


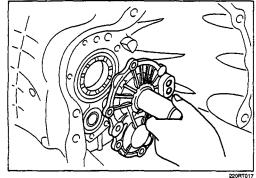
#### 220LV004

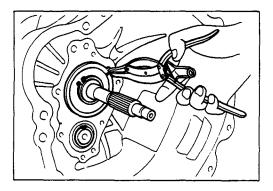
### **Disassembly Steps**

- ▲ 1. Speedometer sensor and speedometer driven gear
  - 2. Gear control box assembly
- ▲ 3. Front cover with oil seal
- 4. Counter front bearing snap ring
- 5. Front bearing snap ring

- 6. Rear cover with oil seal
- 7. Transmission case
- 8. Intermediate plate with gear assembly









 Speedometer Sensor and Speedometer Driven Gear

Mark the plate 1 and bush 2 alignment for reassembly.

#### 3. Front Cover with Oil Seal

Remove the front cover with oil seal from the transmission case.

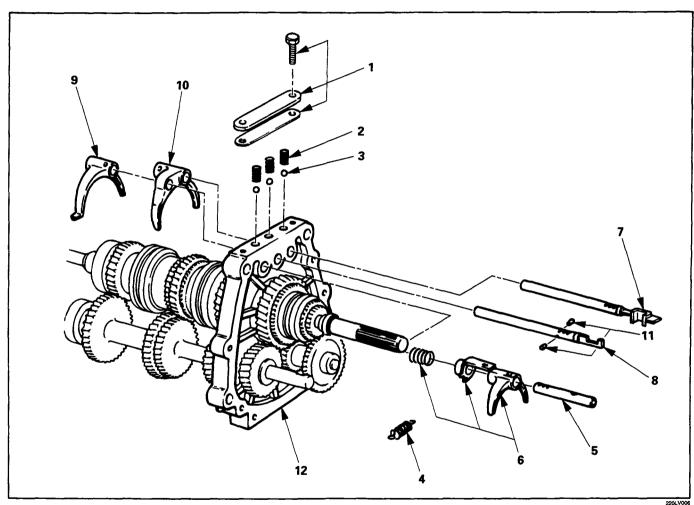
- 4. Counter Front Bearing Snap Ring
- 5. Front Bearing Snap Ring

Use a pair of snap ring pliers to remove the snap ring.



### **MINOR COMPONENTS**

# INTERMEDIATE PLATE AND GEAR ASSEMBLY, DETENT, SHIFT ARM ASSEMBLY, AND INTERLOCK PIN

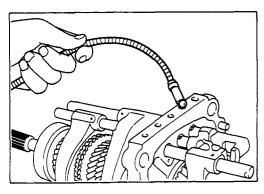


#### 2200,000

#### **Disassembly Steps**

- 1. Detent spring plate and gasket
- 2. Detent spring
- ▲ 3. Detent ball
  - 4. Spring
  - 5. Rev-5th shift rod
  - 6. Rev-5th shift arm and reverse inhibitor

- 7. 1st-2nd shift rod
- 8. 3rd-4th shift rod9. 3rd-4th shift arm
- ▲ 10. 1st-2nd shift arm
  - 11. Interlock pin
  - 12. Intermediate plate and gear assembly

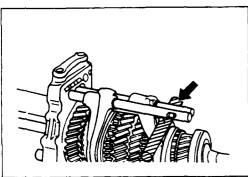




#### 3. Detent Ball

Use a magnetic hand to remove the detent balls from the intermediate plate.

Take care not to lose the detent balls.

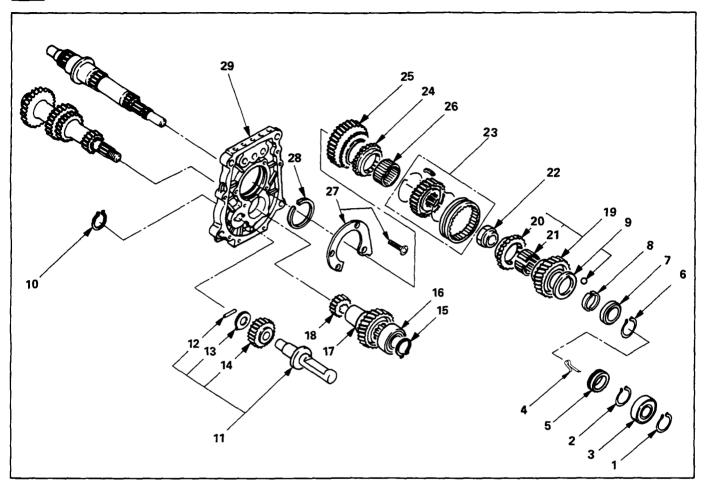


- 8. 3rd-4th Shift Rod
- 9. 3rd-4th Shift Arm
- 10. 1st-2nd Shift Arm
  - Hold a round bar against the shift arm end.
     This will prevent damage to other components.

- 2) Use a spring pin remover to remove the shift arm spring pin from the shift arm and the shift rod.
- Move the 3rd-4th shift rod forward.
   Take care not to lose the interlock pins.



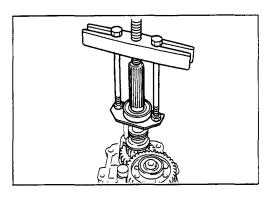
#### **REVERSE GEAR AND 5TH GEAR**



### **Disassembly Steps**

- 1. Bearing snap ring
- 2. Bearing snap ring
- ▲ 3. Ball bearing
  - 4. Clip
  - 5. Speedometer drive gear
  - 6. Retainer snap ring
  - 7. Retaining ring
  - 8. Thrust plate
  - 9. Thrust washer and lock ball
- ▲ 10. Reverse gear snap ring
  - 11. Reverse shaft
  - 12. Idler shaft pin
  - 13. Thrust washer
  - 14. Reverse idler gear15. Bearing snap ring

- ▲ 16. Ball bearing
- ▲ 17. Counter 5th gear
  - 18. Counter reverse gear
  - 19. 5th gear
  - 20. 5th block ring
- ▲ 21. Needle bearing
- ▲ 22. Mainshaft nut
- ▲ 23. Rev-5th synchronizer assembly
- ▲ 24. Reverse block ring
- ▲ 25. Reverse gear
  - 26. Needle bearing
- ▲ 27. Bearing plate and screw
- ▲ 28. Bearing snap ring
- ▲ 29. Intermediate plate



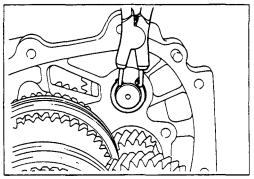


### 3. Ball Bearing

Set the bearing remover to the bearing and the mainshaft end to remove the bearing.

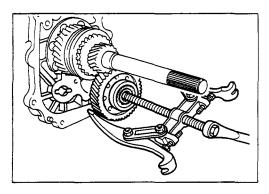
Bearing Remover: 5-8840-2155-0 (J-32717)

Puller : 5-8840-2027-0



#### 10. Reverse Gear Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

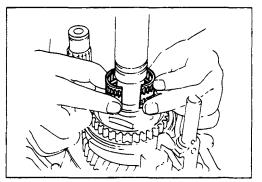




#### 16. Ball Bearing

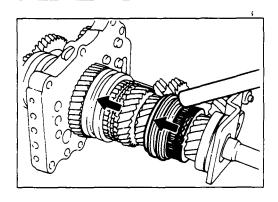
#### 17. Counter 5th Gear

Use the bearing remover to remove the bearing.



#### 21. Needle Bearing

Remove the needle bearing (2 piece type).

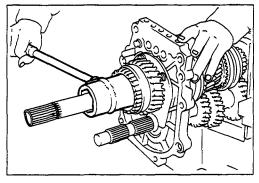




#### 22. Mainshaft Nut

- 1) Engage the 3rd-4th synchronizer with the 3rd gear.
- 2) Engage the 1st-2nd synchronizer with the 1st gear.
- 3) Attach the holding fixture to the mainshaft and the counter gear.

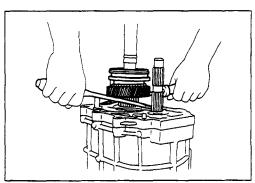
Holding Fixture: 5-8840-2160-0 (J-37224)





4) Use the mainshaft nut wrench to remove the mainshaft nut.

Wrench: 5-8840-2156-0 (J-37219)

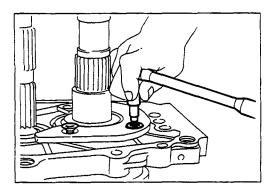




#### 23. Rev.-5th Synchronizer Assembly

- 24. Reverse Ring
- 25. Reverse Gear

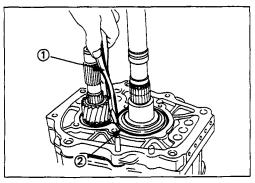
Use screw drivers between the reverse gear and bearing plate to remove the Rev.-5th synchronizer assembly together with reverse ring and gear.



#### 27. Bearing Plate and Screw

Use the torx bit wrench to remove the bearing plate screw from the intermediate plate.

Torx Bit Wrench: 5-8840-0047-0 (J-37225: T45)

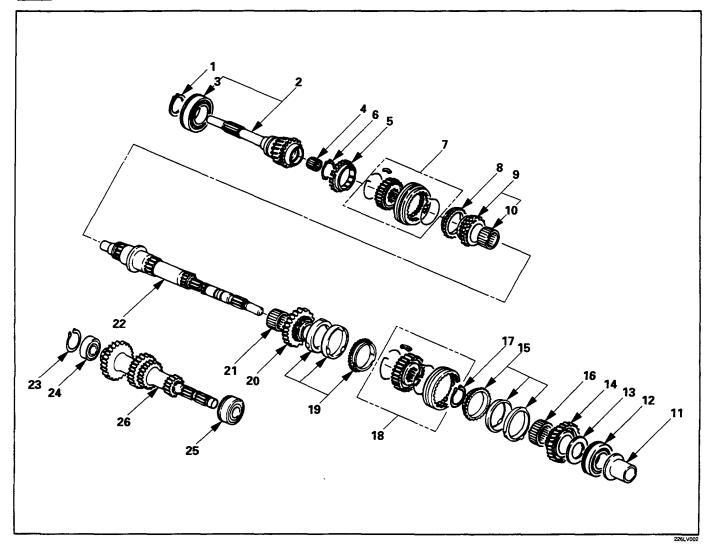


- 28. Bearing Snap Ring
- 29. Intermediate Plate
  - 1) Insert the snap ring pliers into the mainshaft bearing snap ring hole.
  - Use the snap ring pliers 1 to force open the mainshaft bearing snap ring 2.
    - Hold the snap ring open with the pliers.
  - Push the intermediate plate toward the rear of the transmission to remove it.

The ball bearing snap ring will come free.



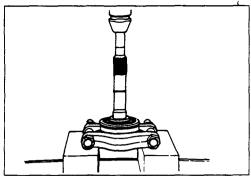
### TOP GEAR SHAFT, MAIN GEAR SHAFT, AND COUNTER GEAR

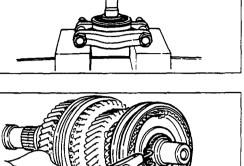


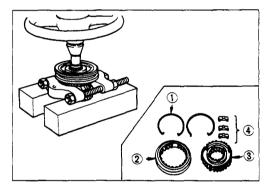
### **Disassembly Steps**

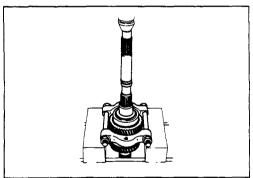
- 1. Top gear shaft snap ring
- 2. Top gear shaft
- ▲ 3. Top gear ball bearing
  - 4. Needle bearing
  - 5. Top block ring
- ▲ 6. Mainshaft snap ring
- ▲ 7. 3rd-4th synchronizer assembly
  - 8. 3rd block ring
  - 9. 3rd gear
  - 10. Needle bearing
- ▲ 11. Needle bearing collar
- ▲ 12. Mainshaft ball bearing▲ 13. 1st gear thrust bearing and plate

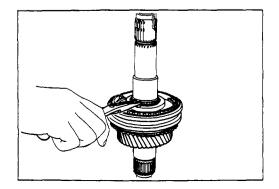
- ▲ 14. 1st gear
- 15. 1st block ring (set)
- 16. Needle bearing
- ▲ 17. Clutch hub snap ring
- ▲ 18. 1st-2nd synchronizer assembly
- ▲ 19. 2nd block ring (set)
- ▲ 20. 2nd gear
  - 21. Needle bearing
  - 22. Mainshaft
  - 23. Bearing snap ring
- ▲ 24. Counter gear front bearing
  - 25. Counter gear center bearing
  - 26. Counter gear













#### 3. Top Gear Ball Bearing

Use a bench press and the bearing replacer to remove the ball bearing.

Bearing Replacer: 5-8840-0015-0 (J-22912-01)

#### 6. Mainshaft Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

#### 7. 3rd-4th Synchronizer Assembly

- 1) Use a bench press and the bearing replacer to remove the synchronizer assembly as a set.
- 2) Disassemble the synchronizer assembly.
  - 1) Springs
  - ② Sleeve
  - 3 Clutch Hub
  - (4) Inserts

#### Note:

Mark the hub and sleeve alignment for reassembly.

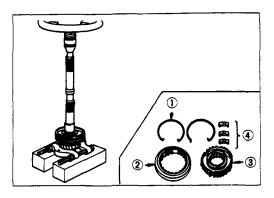
- 11. Needle Bearing Collar
- 12. Mainshaft Ball Bearing
- 13. 1st Gear Thrust Bearing and Plate

#### 14. 1st Gear

Use a bench press and the bearing replacer to remove the ball bearing.

#### 17. Clutch Hub Snap Ring

Use a pair of snap ring pliers to remove the snap ring.





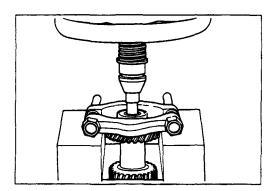
- 18. 1st-2nd Synchronizer Assembly
- 19. 2nd Block Ring (Set)
- 20. 2nd Gear
  - 1) Use a bench press and the bearing remover to remove the 2nd gear together with synchronizer assembly.

Remover: 5-8840-0015-0 (J-22912-01)

- 2) Disassemble the synchronizer assembly.
  - Springs
  - 2 Sleeve
  - ③ Clutch Hub
  - (4) Inserts

#### Note:

Mark the hub and sleeve alignment for reassembly.





#### 24. Counter Gear Front Bearing

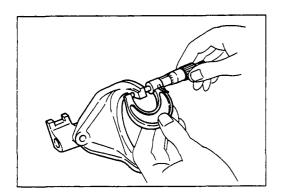
Use a bench press and the bearing remover to remove the bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)



## **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

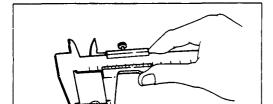




#### SHIFT ARM THICKNESS

Use a micrometer to measure the shift arm thickness. If the measured value is less than the specified limit, the shift arm must be replaced.

Shift Arm Thickness		<u>mm(in)</u>	
	Standard	Limit	
1st-2nd	9.60-9.85 (0.378-0.388)		
3rd-4th Rev5th	9.60-9.80 (0.378-0.386)	9.0 (0.354)	



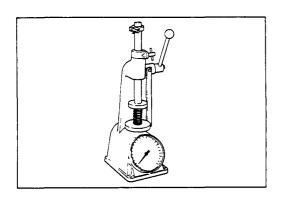


#### **DETENT SPRING FREE LENGTH**

Use a venier caliper to measure the detent spring free length.

If the measured value is less than the specified limit, the detent spring must be replaced.

mm(in)
Limit
26.2 (1.03)

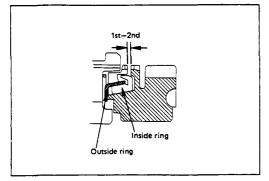




#### **DETENT SPRING TENSION**

Use a spring tester to measure the detent spring tension. If the measured value is less than the specified standard, the detent spring must be replaced.

Detent Spring Tension kg	
Compressed Height	Standard
20 mm (0.787 in)	8.9–9.9 (19.6–21.8/87.2–97)



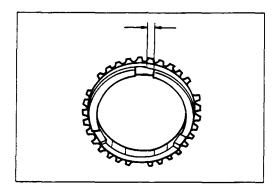


#### BLOCK RING AND DOG TEETH CLEARANCE

Use a thickness gauge to measure the clearance between the block ring and the dog teeth.

If the measured value exceeds the specified limit, the block ring must be replaced.

Block Ring and Dog Teeth (	Clearance mm(in)
Standard	Limit
1.5 (0.059)	0.8 (0.032)



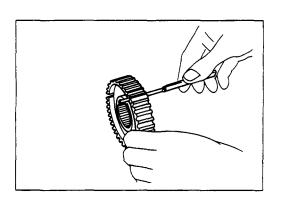


#### **BLOCK RING AND INSERT CLEARANCE**

Use a vernier caliper or thickness gauge to measure the clearance between the block ring and the insert.

If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

ock Ring ar	nd Insert Clearance	<u> </u>
	Standard	Limit
3rd-4th	3.46-3.74 (0.136-0.147)	4.0 (0.158)
1st-2nd	4.34-4.66 (0.171-0.183)	4.9 (0.193)
Rev5th	3.59-3.91 (0.141-0.154)	4.1 (0.161)



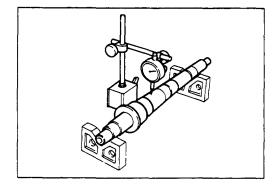


#### **CLUTCH HUB AND INSERT CLEARANCE**

Use a thickness gauge to measure the clearance between the clutch hub and the insert.

If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch Hub a	h Hub and Insert Clearance	
	Standard	Limit
3rd-4th	0.01-0.19 (0.0004-0.0075)	
1st-2nd Rev5th	0.09-0.31 (0.0035-0.0122)	0.4 (0.016)



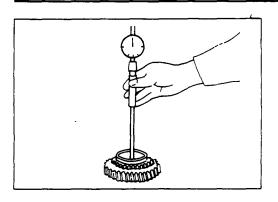


#### **MAINSHAFT RUN-OUT**

- 1. Install the mainshaft to a grinding machine.
- 2. Use a dial indicator to measure the mainshaft central portion run-out.

If the measured mainshaft run-out exceeds the specified limit, the mainshaft must be replaced.

Mainshaft Run Out	mm(in)
, Limit	-
0.05 (0.0020)	





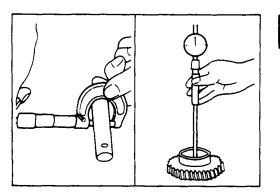
#### **GEAR INSIDE DIAMETER**

Use an inside dial indicator to measure the gear inside diameter.

If the measured value is less than the specified limit, the gear must be replaced.

ear Inside Diameter		mm(in)
	Standard	Limit
1st 3rd	45.000-45.013 (1.771-1.772)	45.100 (1.776)
2nd	52.000-52.013 (2.047-2.048)	52.100 (2.051)
Rev.	48.000-48.013 (1.889-1.890)	48.100 (1.894)
5th	32.000-32.013	32.100 (1.264)

(1.259-1.260)





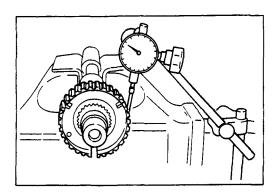
#### REVERSE IDLER GEAR AND IDLER GEAR SHAFT **CLEARANCE**

- 1. Use a micrometer to measure the idler gear shaft diameter.
- 2. Use an inside dial indicator to measure the idler gear inside diameter.
- 3. Calculate the idler gear and idler gear shaft clearance. Idler gear inside diameter - idler gear shaft diameter = idler gear and idler gear shaft clearance.

If the measured value exceeds the specified limit, the idler gear and/or the idler gear shaft must be replaced.

Idler Gear and Idle	er Gear Shaft (	Clearance	mm(in)
	1 1		1

Standard	Limit
0.041 - 0.074 (0.0016 - 0.0029)	0.150 (0.0059)





#### **CLUTCH HUB SPLINE PLAY**

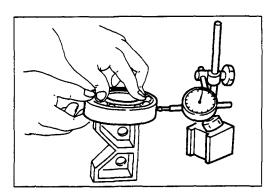
- 1. Set a dial indicator to the clutch hub to be measured.
- 2. Move the clutch hub as far as possible to both the right and the left.

Note the dial indicator reading.

It the measured value exceeds the specified limit, the clutch hub must be replaced.

mm(in)

<u></u>	Standard	Limit
1st-2nd 3rd-4th	0-0.1 (0-0.0039)	0.2 (0.0079)
Rev5th	0-0.2 (0-0.0079)	0.3 (0.0118)





#### **BALL BEARING PLAY**

Use a dial indicator to measure the ball bearing play.

Ball Bearing Play	mm(in)
Limit	
0.2 (0.007	9)

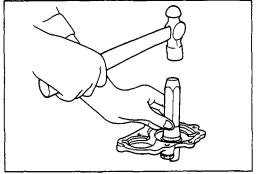


#### FRONT COVER OIL SEAL

Oil Seal Replacement

Oil Seal Removal

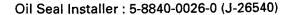
Use a screwdriver to pry the oil seal from the front cover.





#### Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the front cover.



۳.

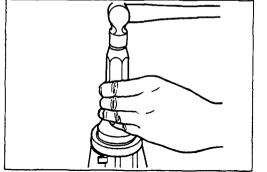
2. Apply gear oil to the oil seal lip.

#### **REAR COVER OIL SEAL**

Oil Seal Replacement

Oil Seal Removal

Use a screwdriver to pry the oil seal from the rear cover.







#### Oil Seal Installation

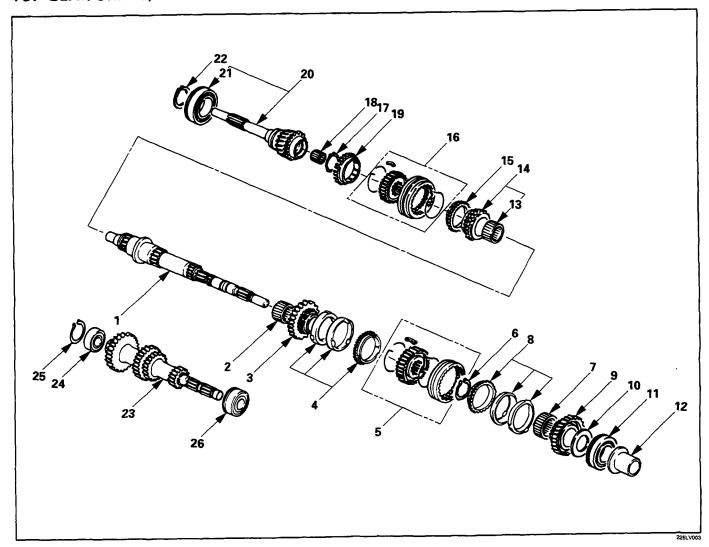
 Use the oil seal installer to install the oil seal to the rear cover.

Oil Seal Installer: 5-8522-0050 (J-29769)

2. Apply engine oil to the oil seal lip.

### MINOR COMPONENTS

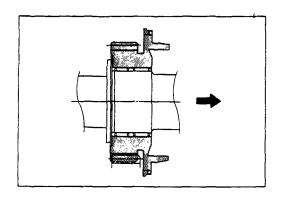
## TOP GEAR SHAFT, MAIN GEAR SHAFT, AND COUNTER GEAR



#### Reassembly Steps

- 1. Mainshaft
- ▲ 2. Needle bearing
- ▲ 3. 2nd gear
  - 4. 2nd block ring (set)
- ▲ 5. 1st-2nd synchronizer assembly
- ▲ 6. Clutch hub snap ring
- ▲ 7. Needle bearing
  - 8. 1st block ring (set)
- ▲ 9. 1st gear
- ▲ 10. 1st gear thrust bearing and plate
- ▲ 11. Mainshaft ball bearing
- ▲ 12. Needle bearing collar
- ▲ 13. Needle bearing

- ▲ 14. 3rd gear
  - 15. 3rd block ring
- ▲ 16. 3rd-4th synchronizer assembly
- ▲ 17. Mainshaft snap ring
  - 18. Needle bearing
  - 19. Top block ring
  - 20. Top gear shaft
- ▲ 21. Top gear ball bearing
- ▲ 22. Top gear shaft snap ring
  - 23. Counter gear
- ▲ 24. Counter gear front bearing
- 25. Snap ring
- 26. Counter gear center bearing



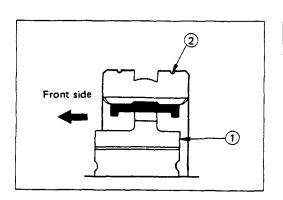






- 1) Apply engine oil to the needle bearing and the 2nd gear thrust surfaces.
- 2) Install the needle bearing and the 2nd gear to the mainshaft.

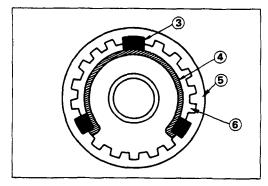
The 2nd gear dog teeth must be facing the transmission rear side.





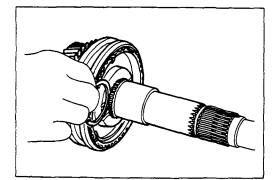
#### 5. 1st-2nd Synchronizer Assembly

1) Turn the clutch hub face ① shallow toward the sleeve small groove ② on the outer circumference.



- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs 4 are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub (5) and the sleeve (6) slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft.

  The clutch hub face (with the heavy boss) must be facing the 2nd gear side.





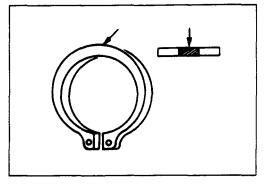
#### 6. Clutch Hub Snap Ring

 Select the snap ring which will provide the minimum clearance between the 1st-2nd clutch hub and the snap ring.

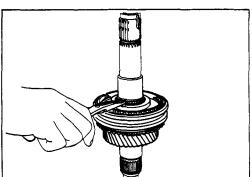
There are three snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance	mm(in
Standard	
0 - 0.1 (0 - 0.0039)	



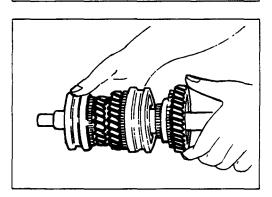
Snap Ring Availability	mm(in)	
Thickness	Color-Coding	
1.80 (0.071)	White	
1.85 (0.073)	Yellow	
1.90 (0.075)	Blue	



2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

**Snap Ring Pliers** 

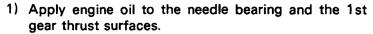
The snap ring must be fully inserted into the mainshaft snap ring groove.





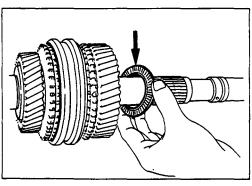
#### 7. Needle Bearing

9. 1st Gear



2) Install the needle bearing and the 1st gear to the mainshaft.

The 1st gear dog teeth must be facing the transmission front side.

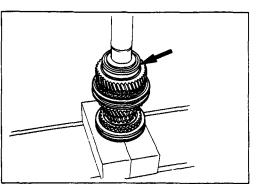




#### 10. 1st Gear Thrust Bearing and Plate

Install the thrust bearing and the race to the main shaft.

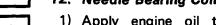
The thrust bearing side must be facing the transmission front side.





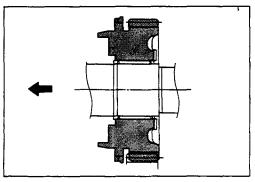
#### 11. Mainshaft Ball Bearing

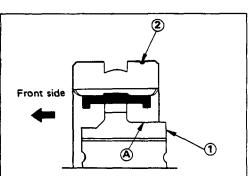
#### 12. Needle Bearing Collar

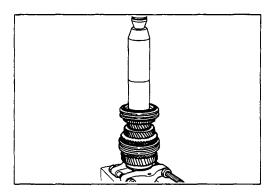


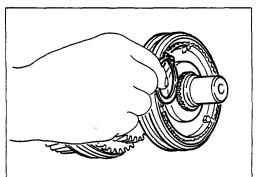
- 1) Apply engine oil to the ball bearing and the mainshaft.
- Install the ball bearing and collar to the mainshaft.
   The ball bearing snap ring groove must be facing the transmission rear side.
- 3) Use a bench press to slowly force the collar into place.

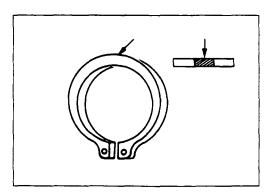
Installer: 5-8840-2195-0 (J-6133-01)







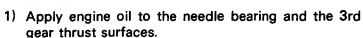






#### 13. Needle Bearing

#### 14. 3rd Gear

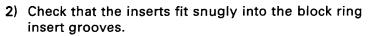


2) Install the needle bearing and the 3rd gear to the mainshaft.

The 3rd gear dog teeth must be facing the transmission front side.

#### 16. 3rd-4th Synchronizer Assembly

1) Turn the clutch hub face ① with the heavy boss A toward the sleeve small groove ② on the outer circumference.



- 3) Check that the insert springs are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub and the sleeve slide smoothly.
- 5) Install the synchronizer assembly to the main shaft. The clutch hub face (with the heavy boss) must be facing the 3rd gear side.



#### 17. Mainshaft Snap Ring

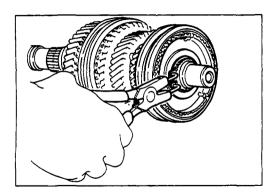
1) Select the snap ring which will provide the minimum clearance between the 3rd-4th clutch hub and the snap ring.

There are three snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

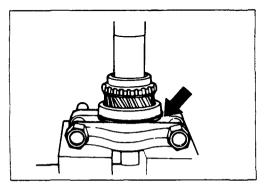
Clutch Hub and Snap Ring Clearance	mm(in)
Standard	
0 — 0.1 (0 — 0.0039)	

vailability mm(in	
Color-Coding	
White	
Yellow	
Blue	



2) Use a pair of snap ring pliers to install the snap ring to

The snap ring must be fully inserted into the mainshaft snap ring groove.





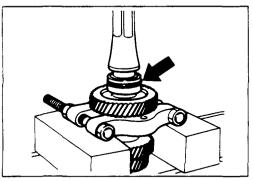
#### 21. Top Gear Ball Bearing

#### 22. 4th Gear Shaft Snap Ring

1) Use a bench press to install the top gear shaft ball bearing to the mainshaft.

The snap ring groove must be facing the transmission front side.

2) Use a pair of snap ring pliers to install the snap ring to the bearing.



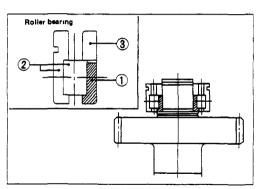


#### 24. Counter Gear Front Bearing

Use a bench press to install the counter gear front bearing to the mainshaft.

The snap ring groove must be facing the transmission front side.

Bearing Installer: 5-8840-2194-0 (J-35283)







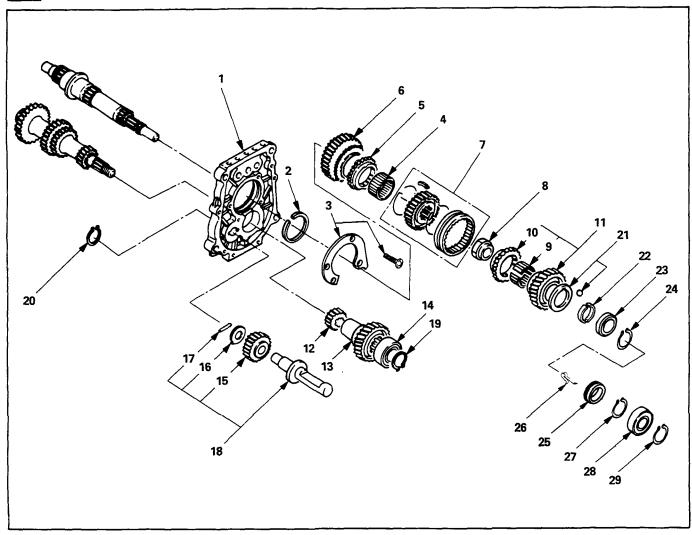
- 1) Apply engine oil to the bearing and install the inner race ① and outer race with roller ② in the proper direction to the mainshaft.
- 2) Then install the inner race ③ with taper side turned to outer race ②.

#### Note:

The inner race ③ should be installed with stamp on die face side turned to the front side of transmission.



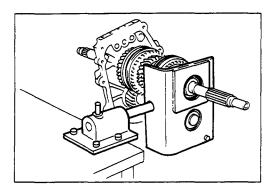
#### **REVERSE GEAR AND 5TH GEAR**

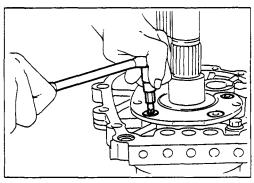


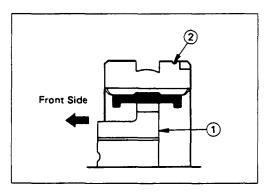
#### Reassembly Steps

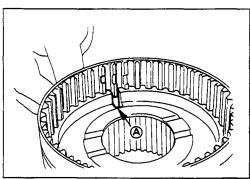
- ▲ 1. Intermediate plate
  - 2. Bearing snap ring
- ▲ 3. Bearing plate and screw
  - 4. Needle bearing
  - 5. Reverse block ring
  - 6. Reverse gear
- 7. Rev.-5th synchronizer assembly
- ▲ 8. Mainshaft nut
  - 9. Needle bearing
  - 10. 5th block ring
  - 11. 5th gear
- ▲ 12. Counter reverse gear
  - 13. Counter 5th gear
  - 14. Ball bearing
  - 15. Reverse idler gear

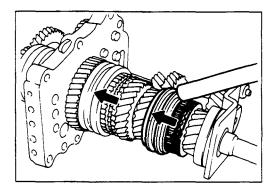
- 16. Thrust washer
- 17. Idler shaft pin
- 18. Reverse idler shaft
- ▲ 19. Bearing snap ring
- ▲ 20. Reverse gear snap ring
- ▲ 21. Thrust washer and lock ball
  - 22. Thrust plate
  - 23. Retaining ring
  - 24. Retainer snap ring
  - 25. Speedometer drive gear
- 26. Clip
- 27. Bearing snap ring
- ▲ 28. Ball bearing
  - 29. Bearing snap ring















- 1. Intermediate Plate
- 1) Mesh the counter gear with the mainshaft assembly.
- 2) Install the holding fixture to the mainshaft and the counter gear.

Holding Fixture: 5-8840-2160-0 (J-37224) Holding Base: 5-8840-0003-0 (J-3289-20)

- 3) Place the holding fixture (with the mainshaft and the countershaft) in a vise.
- 4) Install the intermediate plate.







### 3. Bearing Plate and Screw

- 1) Apply recommended thread locking agents or its equivalent to each of the bearing plate screw threads.
- 2) Tighten the screws to the specified torque.

Torx Bit Wrench: 5-8840-0047-0 (J-37225 : T45)

Bearing Plate Screw Torque

kg·m (lb·ft/N·m)

 $1.45 \pm 0.35$  (10.5 ± 2.5/14.2 ± 3.4)

#### 7. Rev-5th Synchronizer Assembly

- 1) Turn the clutch hub face (1) toward the sleeve small groove (2) on the outer circumference.
- 2) Install the synchronizer assembly to the mainshaft. The clutch hub face (with the heavy boss) must be facing the reverse gear side.



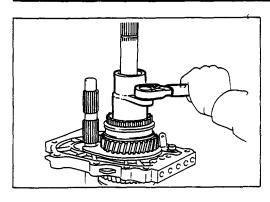
The clutch hub groove (A) must be aligned with the key groove of sleeve.



#### 8. Mainshaft Nut

1) Mesh the 1st-2nd synchronizer with both the 1st and 3rd gears (double engagement).

This will prevent the mainshaft from turning.





- 2) Install the mainshaft hub nut.
- 3) Use the mainshaft nut wrench to tighten the mainshaft nut to the specified torque.

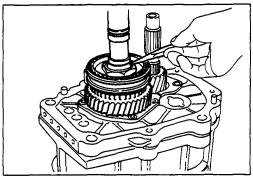
Wrench: 5-8840-2156-0 (J-37219)



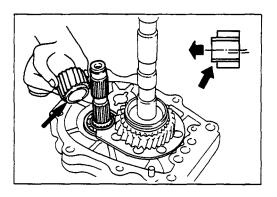
#### Mainshaft Nut Torque

kg·m(lb·ft/N·m)

 $13 \pm 1 (94.0 \pm 7.2/127.4 \pm 9.8)$ 



4) Use a punch to caulk the mainshaft nut.

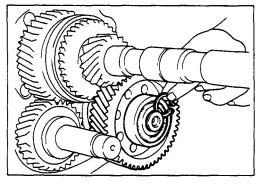




#### 12. Counter Reverse Gear

- 1) Apply engine oil to the counter reverse gear and the reverse gear.
- Install the counter reverse gear to the counter gear.
   Note the projection at either side of the counter reverse gear.

The larger projection must be facing the intermediate plate.





#### 19. Bearing Snap Ring

1) Select the snap ring which will provide the minimum clearance between the ball bearing and the snap ring.

There are six snap ring sizes available.

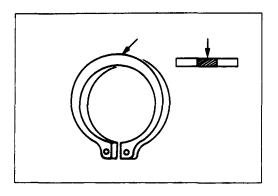
The snap rings are color-coded to indicate their thickness.

Ball Bearing and Snap Ring Clearance

mm(in)

Standard

0 - 0.15 (0 - 0.0059)



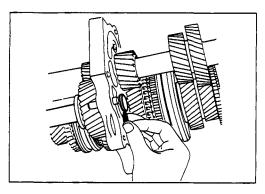


Snap Ring Availability	mm(in)	
Thickness mm(in)	Color-Coding	
1.1 (0.043)	White	
1.2 (0.047)	Yellow	
1.3 (0.051)	Blue	
1.4 (0.055)	Pink	
1.5 (0.059)	Green	
1.6 (0.063)	Brown	

2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

Snap Ring Pliers

The snap ring must be fully inserted into the counter 5th gear snap ring groove.





#### 20. Reverse Gear Snap Ring

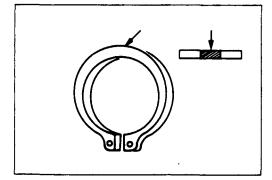
 Select the snap ring which will provide the minimum clearance between the intermediate plate and the snap ring.

There are three snap ring sizes available.

The snap rings are color-coded to indic

The snap rings are color-coded to indicate their thickness.

Intermediate Plate and Snap Ring Clearance	mm(in)
Standard	
0 - 0.15 (0 - 0.0059)	



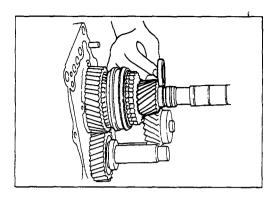
mm(in)
ding
)
v
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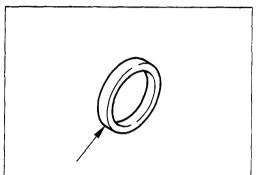
2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

**Snap Ring Pliers** 

The snap ring must be fully inserted into the counter 5th gear snap ring groove.

mm(in)







#### 21. Thrust Washer and Lock Ball

1) Use a thickness gauge to measure the clearance between the 5th gear and the thrust washer.

5th Gear and Thrust Washer Clearance	mm(in)	
Standard		
0.10 - 0.25 (0.0039 - 0.0098)		

If required, replace the existing thrust washer with a new thrust washer to bring the clearance to specification.

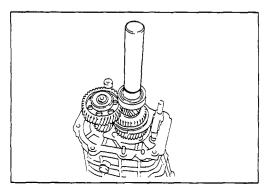
There are four thrust washer sizes available.

Thrust Washer Availability

The snap rings are color-coded to indicate their thickness.

11111/113/
Color-Coding
White
Yellow
Green
Blue

- 2) Apply grease to the thrust washer and the lock ball.
- 3) Install the thrust washer and the lock ball.



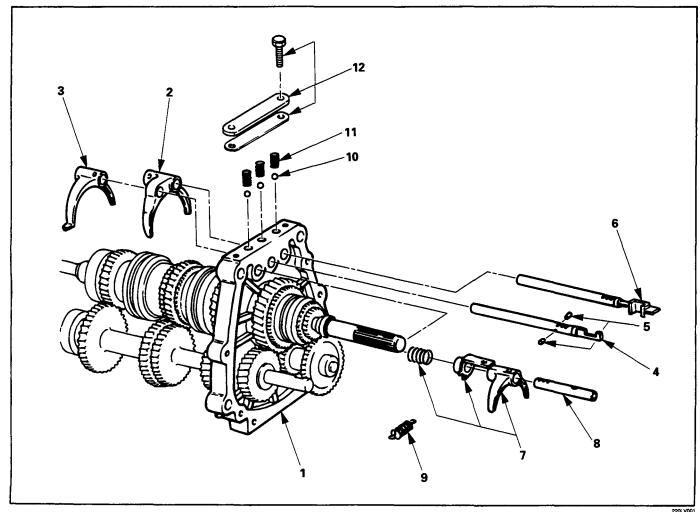


### 28. Ball Bearing

Use the installer to install the ball bearing to the mainshaft. Installer: 5-8840-2159-0 (J-37223)



### INTERMEDIATE PLATE AND GEAR ASSEMBLY, DETENT, SHIFT ARM **ASSEMBLY, AND INTERLOCK PIN**



### **Reassembly Steps**

- 1. Intermediate plate and gear assembly
- 2. 1st-2nd shift arm
- 3. 3rd-4th shift arm ▲ 4. 3rd-4th shift rod
- 5. Interlock pin
  - 6. 1st-2nd shift rod

- 7. Rev-5th shift arm and reverse inhibitor
- 8. Rev-5th shift rod
- 9. Spring
- 10. Detent ball
- 11. Detent spring
- ¹▲ 12. Detent spring plate and gasket



- 4. 3rd-4th Shift Rod
- 5. Interlock Pin
- Install the interlock pin to the shift rod.
- 2) Install the shift rod together with the interlock pin to the intermediate plate.

Do not allow the interlock pin to fall from the shift rod.



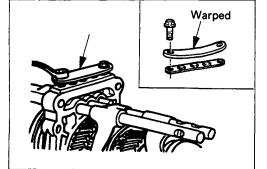
#### 12. Detent Spring Plate and Gasket

- 1) Install the new-detent plate and new gasket onto the transmission case into the correct direction.
- 2) Tighten the detent spring plate bolts to the specified torque.

**Detent Spring Plate Bolt Torque** 

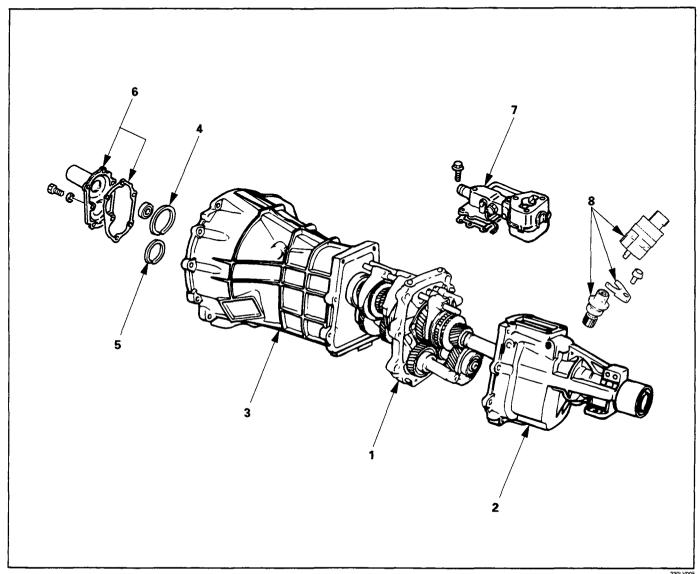
kg·m(lb·ft/N·m)

1.5 (10.8/14.7)





## **MAJOR COMPONENTS**



### **Reassembly Steps**

- 1. Intermediate plate with gear assembly 

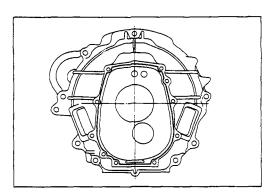
  5. Counter front bearing snap ring
- 2. Rear cover with oil seal
- 3. Transmission case 4. Front bearing snap ring

- 6. Front cover with oil seal
- ▲ 7. Gear control box assembly
  - 8. Speedometer driven gear and speedometer sensor



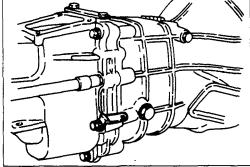
- 1. Intermediate Plate with Gear Assembly
- Apply a light coat of oil to the transmission case top gear shaft ball bearing fitting faces and the shift rods.
   This will facilitate smooth installation.
- 2) Install the intermediate plate assembly.
- 3) Pull out the top gear shaft until the ball bearing snap ring groove protrudes from the transmission case front cover fitting face.

Avoid subjecting the mainshaft to sudden shock or stress.





- 2. Rear Cover with Oil Seal
- 3. Transmission Case
- 1) Apply recommended liquid gasket or its equivalent to the transmission case and rear cover fitting surfaces.



- 2) Install the rear cover and the transmission case to the intermediate plate.
- 3) Tighten the rear cover bolts to the specified torque.

Rear Cover Bolt Torque kg  $4.0 \pm 0.8 (28.9 \pm 1.4/39.2 \pm 1.96)$ 

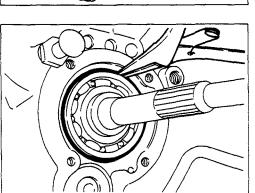
kg·m (lb·ft/N·m)

4. Front Bearing Snap Ring

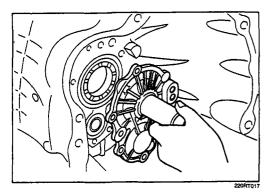
5. Counter Front Bearing Snap Ring

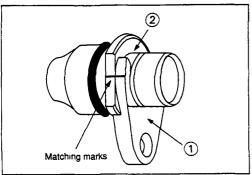
Use a pair of snap ring pliers to install the snap rings to the mainshaft.

The snap rings must be fully inserted into the ball bearing snap ring groove.



#### 7B1-44 MUA MODEL









- Apply recommended liquid gasket or its equivalent to the through bolt threads.
- 2) Install the new gasket and the front cover to the transmission case

Take care not to damage the oil seal.

3) Tighten the front cover bolts to the specified torque. Front Cover Bolt Torque kg·m (Ib-ft/N·m)

 $1.9 \pm 0.4$  (13.7  $\pm 2.9/18.6 \pm 3.9$ )





#### 7. Speedometer Driven Gear and Speedometer Sensor

1) Align the matching marks on plate ① and bush ②, then tighten the bolt.

**Bolt Torque** 

kg·m (lb·ft/N·m)

1.5 (10.8/14.7)

2) Install the speedometer sensor.

Speedometer Sensor Torque

kg·m (lb·ft/N·m)

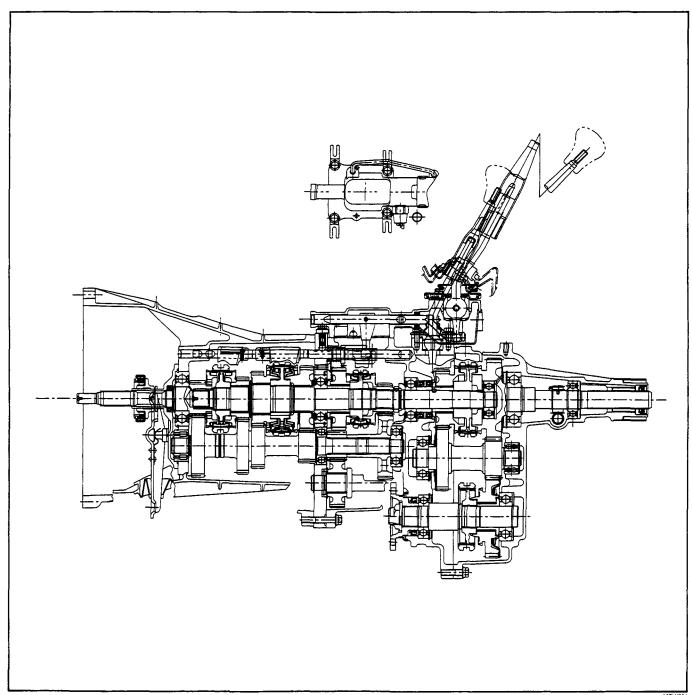
2.8 (20/27)

## 4 x 4 MODEL TRANSMISSION

### MAIN DATA AND SPECIFICATIONS

		MUA 5C	MUA 5S
Transmission type		Fully synchronized 5-forward and reverse gears.	
Transfer case type		Constant mesh type Low-High and 2H-4H gears.	
Gear ratio : Transmissior	1st	3.767	4.357
	2nd	2.248	2.502
	3rd	1.404	1.501
	4th	1.000	1.000
	5th	0.809	0.809
	Rev.	3.875	3.970
Transfer	High	1.000	
	Low	2.051	
Oil capacity: Transmission	lit (US gal.)	2.95 (0.78)	
: Transfer	lit (US gal.)	1.45 (0.38)	

# **GENERAL DESCRIPTION**



The transmission is designed for the quietest possible operation.

A longer center distance (77.5 mm (3.05 in)) provides increased durability.

Principle parts of the transmission are the integral clutch housing, the intermediate plate, the rear cover, and the gears.

The gear control box is built-in to the transfer case.

Transfer gear ratio is 1: 2.051.

A07LV00

# **TORQUE SPECIFICATIONS**

# 2

# STANDARD BOLTS

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m / lb-ft)

N·m (kg·m / lb·π)						
Strength		4.8/4T	7T	8	.8	9.8/9T
	Class			Refined	Non-Refined	
	Bolt Identifi- cation	4		8	8	9
	Bolt Diameterx Pitch (mm)	No mark				
Standard Hex. Head Bolt	M6 × 1.0 M8 × 1.25 M10 × 1.25 M12 × 1.25 M14 × 1.5 M16 × 1.5 M20 × 1.5 M20 × 1.5 M24 × 2.0 * M10 × 1.5 * M12 × 1.75	6 (0.6 / 52 lb·in) 13 (1.3 / 113 lb·in) 27 (2.8 / 20) 61 (6.3 / 45) 96 (9.8 / 71) 130 (13.3 / 96) 188 (19.2 / 139) 258 (26.3 / 190) 332 (33.9 / 245) 449 (45.8 / 331) 26 (2.7 / 20) 57 (5.8 / 42)	7 (0.7 / 61 lb·in) 17 (1.7 / 12) 37 (3.8 / 27) 76 (7.8 / 56) 116 (11.8 / 85) 170 (17.3 / 125) 244 (24.9 / 180) 337 (34.4 / 249) 453 (46.3 / 335) 570 (58.2 / 421) 36 (3.7 / 27) 71 (7.2 / 52)	20 (2. 42 (4. 87 (8. 133 (13 193 (19 278 (28 385 (39 517 (52 651 (66 41 (4. 80 (8.	69 lb·in) 0 / 14) 3 / 31) 9 / 64) 3.6 / 98) .7 / 143) .3 / 205) .3 / 284) .7 / 381) .3 / 480) 2 / 30) 2 / 59)	24 (2.4 / 17) 50 (5.1 / 37) 95 (9.7 / 70) 142 (14.5 / 105) 200 (20.4 / 148) 287 (29.3 / 212) 396 (40.4 / 292) 530 (54.1 / 391) 692 (70.6 / 511) 48 (4.9 / 35) 89 (9.1 / 66)
Flange Bolt	* M14 × 2.0 * M16 × 2.0 M6 × 1.0 M8 × 1.25 M10 × 1.25 M12 × 1.25 M14 × 1.5 M16 × 1.5 M18 × 1.5 M20 × 1.5 M22 × 1.5 M24 × 2.0 * M10 × 1.5 * M12 × 1.75 * M14 × 2.0 * M16 × 2.0	89 (9.1 / 66) 124 (12.7 / 92) 7 (0.7 / 61 lb·in) 15 (1.5 / 11) 31 (3.2 / 23) 69 (7.0 / 51) 104 (10.6 / 77) 145 (14.8 / 127) 30 (3.1 / 22) 64 (6.5 / 47) 97 (9.9 / 72) 137 (14.0 / 101)	110 (11.2 / 81) 162 (16.5 / 119) 8 (0.8 / 69 lb·in) 19 (1.9 / 14) 41 (4.2 / 30) 85 (8.7 / 63) 126 (12.8 / 93) 188 (19.2 / 139) - - 40 (4.1 / 30) 78 (8.0 / 58) 119 (12.1 / 88) 178 (18.2 / 132)	185 (18 9 (0.9 / 22 (2. 47 (4.) 97 (9.) 144 (14 214 (21 46 (4.) 89 (9.) 135 (13.)	2.7 / 92) 2.9 / 137) 78 lb·in) 2 / 16) 8 / 35) 9 / 72) 6 / 106) 8 / 158) - - - 7 / 34) 1 / 66) 8 / 99.7)	133 (13.6 / 98) 191 (19.5 / 141) - 26 (2.7 / 20) 56 (5.7 / 41) 106 (10.8 / 78) 154 (15.7 / 114) 221 (22.5 / 163) - - 54 (5.5 / 40) 99 (10.1 / 73) 144 (14.7 / 107) 210 (21.5 / 155)

The asterisk \* indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.

# (D)

# **FLARE NUTS**

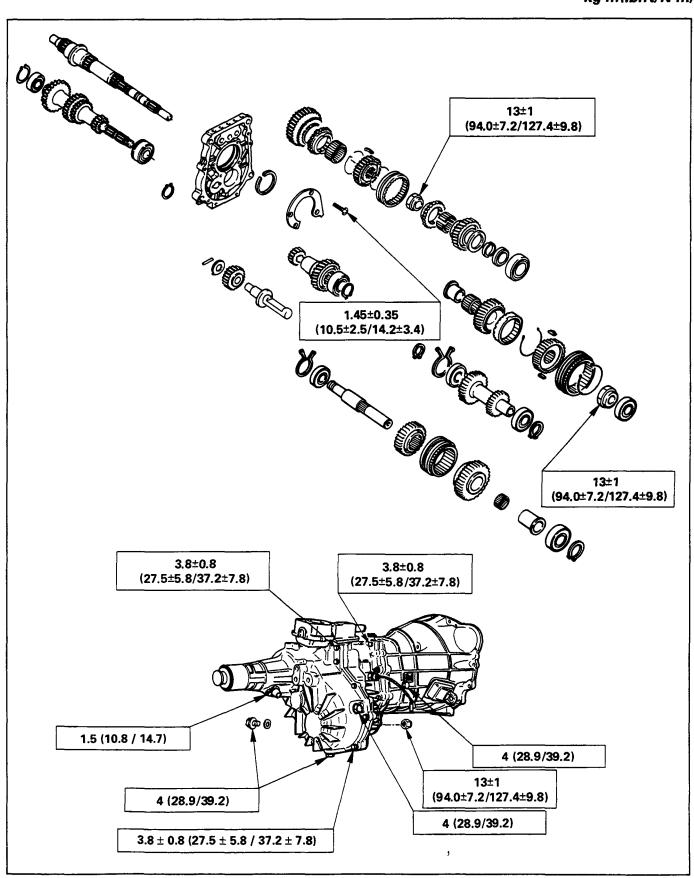
N·m (kg·m / lb·ft)

Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.394)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)



# **SPECIAL PARTS FIXING NUTS AND BOLTS**

kg·m(lb.ft/N·m)





# RECOMMENDED LIQUID GASKET

Type	Brand Name	Manufacturer	Remarks
RTV*	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	For Engine Repairs
Silicon Base	ThreeBond 1215 ThreeBond 1281	Three Bond Three Bond	For Axle Case and Transmission Repairs
Water Base	ThreeBond 1141E	Three Bond	For Engine Repairs
Solvent	ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anerobic	LOCTITE 515 LOCTITE 518	Loctite Loctite	All

<sup>\*</sup> RTV: Room Temperature Vulcanizer

#### Note:

- 1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
- 2. Be careful to use the specified amount of liquid gasket. Follow the manufacturer's instructions at all times.
- 3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.
  - The connecting surfaces must be perfectly dry.
- 4. LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.

  Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.





# **REMOVAL AND INSTALLATION**

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



#### Important Operations — Removal

## **Battery Cable**

Disconnect the negative (-) cable from the battery terminal.

#### **Engine Hood**

Apply setting marks to the engine hood and the engine hood hinges before removing the engine hood.



- 1. Place the gear shift lever in the neutral position.
- 2. Place the transfer change lever in the "H" position.
- 3 Remove the gear shift lever knob and transfer change lever knob.
- 4. Remove the center console assembly and front console assembly.
- 5. Remove the grommet and dust cover.
- 6. Remove the gear shift lever cover bolt.
- 7. Remove the gear shift lever.
- 8. Remove the transfer change lever retainer bolts.
- 9. Remove the transfer change lever and O-ring.

#### Note:

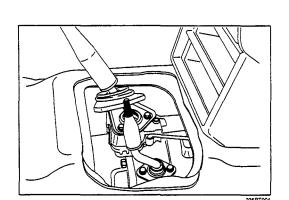
Cover the shift lever and change lever holes to prevent the entry of foreign material into the transmission.

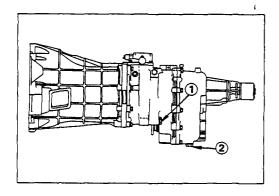
#### Lifting the Vehicle

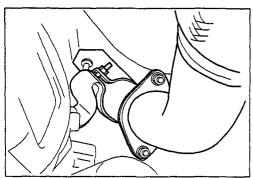
- 1. Jack up the vehicle.
- Place chassis stands at the front and the rear of the vehicle.

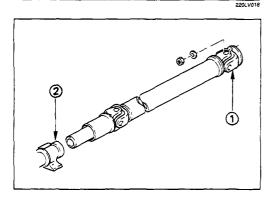
#### **Transfer Case Protector**

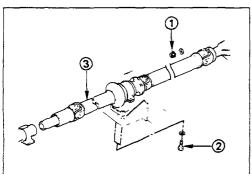
Remove the transfer case protector from the transmission mounting member and the side member.











## Transmission and Transfer Case Oil Draining

- 1. Remove the transmission oil drain plug (1).
- 2. Remove the transfer case oil drain plug (2).
- 3. Replace the drain plug(s) after draining the oil.

#### **Exhaust Pipe**

- 1. Remove the exhaust pipe bracket from the transmission case.
- 2. Remove the front exhaust pipe and 2nd-3rd exhaust pipe.

## Rear Propeller Shaft (Single Shaft Type)

- 1. Remove the propeller shaft flange yoke at the drive pinion side (1).
- 2. Remove the propeller shaft from the transmission main shaft spline ②.

#### Rear Propeller Shaft (Dual Shaft Type)

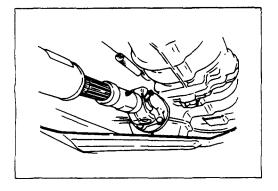
- 1. Apply setting marks to the 2nd propeller shaft flange yoke.
  - This will prevent mispositioning during the installation procedure.
- 2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
- 3. Remove the center bearing retainer bolts 2.
- 4. Remove the 1st propeller shaft ③ with the center bearing and the 2nd propeller shaft.
- Pull the 1st propeller shaft toward the rear of the the entry of foreign material into the transmission.

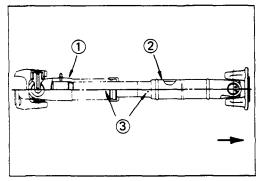
#### Lifting the Vehicle

- 1. Jack up the vehicle.
- 2. Place chassis stands at the front and the rear of the vehicle.

#### **Transfer Case Protector**

Remove the transfer case protector from the transmission mounting member and the side member.





## Front Propeller Shaft

Remove the splined yoke flange bolt at the transfer case side.

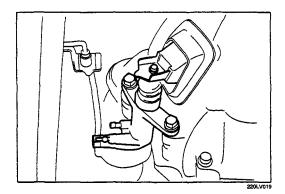
Do not allow the splined yoke to fall away from the front propeller shaft.

If the splined yoke should fall away from the front propeller shaft, align the setting marks ③ on the splined yoke ① and the propeller shaft ② to reassemble the two parts.

The setting marks are punched circles approximately ③ mm (0.12 in) in diameter.

#### **Harness Connector**

Disconnect the 4WD switch connectors, back up light switch connector and the speedometer sensor connector.

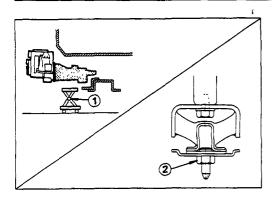


## Slave Cylinder

Remove the slave cylinder from the transmission case.

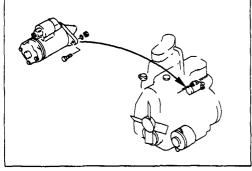
# **Engine Lifting Hanger**

- 1. Attach the engine lifting hanger to the front portion of the engine.
- 2. Attach the lifting wire to both ends of the engine lifting hanger.



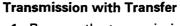
## **Engine Rear Mounting and Mounting Member**

- 1. Support the transmission with a transmission jack
- 2. Remove the engine rear mounting nuts 2.
- 3. Remove the engine rear mounting bolts.
- 4. Loosen the mounting member bolts.
- 5. Remove the mounting member from the sidemembers.
- 6. Remove the engine rear mounting.

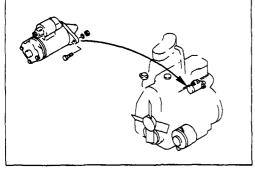


#### Starter Motor

Remove the starter motor from the engine rear plate.



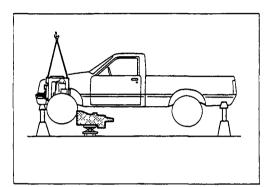
- 1. Remove the transmission nuts and bolts from the engine rear plate.
- 2. Carefully pull the transmission with the transmission jack toward the rear of the vehicle.
- 3. Operate the transmission jack to slowly lower the transmission.





# Important Operations - Installation

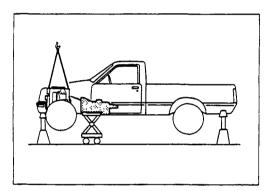
Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.





#### Transmission with Transfer

- 1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
- 2. Place the transmission on a transmission jack.
- 3. Carefully move the transmission jack and transmission into position behind the engine.





4. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

The slope of the engine and the transmission must be the same.

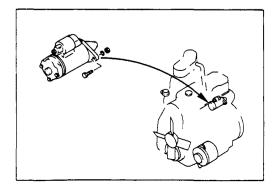
- 5. Align the top gear shaft spline with the clutch driven plate spline.
- 6. Install the transmission to the engine.

Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque kg·m(lb·ft/N·m)

M10:  $4.1 \pm 1.0 (30 \pm 7.2/40 \pm 10)$ 

M12:  $8.0 \pm 1.6$  (58  $\pm$  12/78  $\pm$  16)



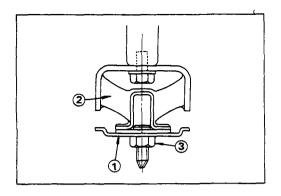
#### Starter Motor

1. Install the starter motor to the engine rear plate.

Starter Motor Bolt Torque

kg·m(lb·ft/N·m)

 $8.0 \pm 1.6 (58 \pm 12/78 \pm 16)$ 





# **Engine Rear Mounting and Mounting Member**

1. Install the engine rear mounting to the transmission.

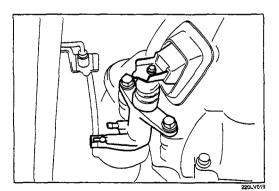
Rear Mounting Bolt Torque	kg-m(lb-ft/N-m)
$4.2 \pm 0.5$ (30 ± 3.6/41 ± 4.9	))

2. Install the mounting member ① to the mounting rubber ②.

Mounting Rubber Nut Torque	kg⋅m(lb⋅ft/N⋅m)
4.2 ± 0.5 (30 ± 3.6/41	± 4.9)

3. Install the mounting member to the sidemembers.

Mounting Member Bolt Torque	kg·m (lb·ft/N·m)
4.2 + 0.5 (30 + 3.6/41 + 4	1.9)





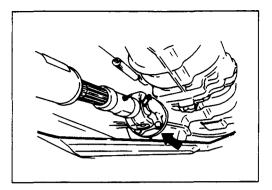
# Slave Cylinder

Install the slave cylinder to the transmission case.

Slave Cylinder Bolt Torque	kg·m(lb·ft/N·m)
$8.0 \pm 1.6 (58 \pm 12/78 \pm 16)$	

#### **Harness Connector**

Connect the 4WD switch connectors back up light switch connector and speedometer sensor connector.





#### Front Propeller Shaft

- 1. Connect the propeller shaft flange yoke to the matching flange.
- 2. Tighten the propeller shaft flange yoke bolt to the specified torque.

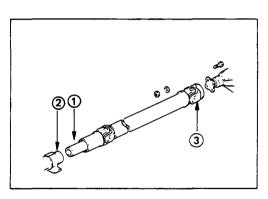
Propeller Shaft Flange Yoke Bolt Torque kg·m (lb·ft/N·m)

 $6.4 \pm 0.4$  (46.3 ± 2.9/62.7 ± 3.9)

#### Note:

If the splined yoke and the front propeller shaft have accidentally separated, align their setting marks and recouple them.

Refer to "FRONT PROPELLER SHAFT REMOVAL".

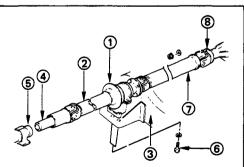




# Rear Propeller Shaft (Single Shaft Type)

- 1. Insert the splined yoke ① with the propeller shaft into the transmission main shaft spline ②.
- 2. Install the propeller shaft flange yoke ③ to the drive pinion side.
- 3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque kg-m (lb-ft/N-m)  $6.4 \pm 0.4$  ( $46.3 \pm 2.9/62.7 \pm 3.9$ )





#### Rear Propeller Shaft (Dual Shaft Type)

- 1. Place the center bearing ① together with the 1st propeller shaft ② and 2nd propeller shaft ⑦ on the No.4 crossmember ③.
- 2. Insert the splined yoke 4 into the transmission main shaft spline 5.
- 3. Tighten the center bearing retainer bolts 6 to the specified torque.

Center Bearing Retainer Bolt Torque kg·m(lb·ft/N·m)

 $6.2 \pm 1.2 (44.8 \pm 8.7/60.8 \pm 11.8)$ 

4. Connect the 2nd propeller shaft 7 and drive pinion side 8.



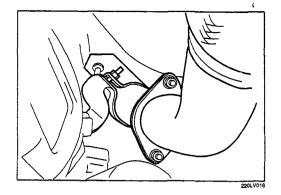
Be sure to align the setting marks applied at disassembly.

5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt

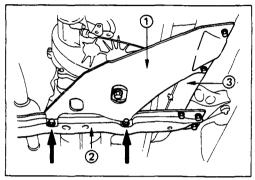
Torque kg·m(lb·ft/N·m)

 $6.4 \pm 0.4 (46.3 \pm 2.9/62.7 \pm 3.9)$ 



#### **Exhaust Pipe**

- 1. Connect the front exhaust pipe and 2nd-3rd exhaust pipe.
- 2. Install the exhaust pipe bracket to the transmission case.

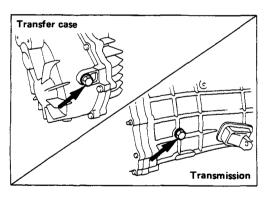




#### **Transfer Case Protector**

- 1. Install the transfer case protector ① to the mounting member ② and the sidemembers ③.
- 2. Tighten the transfer case protector bolts to the specified torque.

Transfer Case Protector Bolt Torque kg·m(lb·ft/N·m)  $3.7 \pm 1.0 (26.8 \pm 7.2/36.3 \pm 9.8)$ 

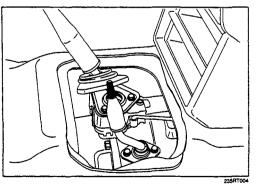




# Gear Shift Lever and Transfer Change Lever

 Replenish the transmission case and the transfer case with the specified engine oil.

Transmission and Transfer Ca	ise Oil lit (US/UK qt.
Transmission Case	2.95 (3.12/2.6)
Transfer Case	1.45 (1.53/1.28)





2. Install the gear shift lever to the gear control box.

Shift Lever Cover Bolt Torque kg·m(lb·ft/N·m)  $2.0 \pm 0.2 (14.5 \pm 1.5/19.6 \pm 1.96)$ 

3. Install the dust cover.



4. Insert the tranfer change lever to the transfer case.

Change Lever Retainer Bolt Torque kg·m(lb·ft/N⋅m)
2.0 ± 0.2 (14.5 ± 1.5/19.6 ± 1.96)

- 5. Install the grommet
- 6. Install the front console assembly and center console assembly.
- 7. Install the gear shift lever and the transfer change lever knobs.

## Lowering the Vehicle

- 1. Place a jack beneath the vehicle.
- 2. Raise the jack to remove the chassis stands.
- 3. Lower the vehicle to the ground.

## **Engine Hood**

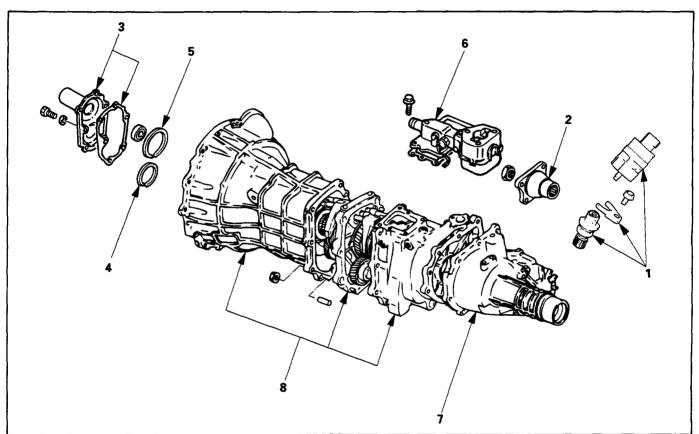
Align the setting marks (applied at removal) on the engine hood and the engine hood hinges to install the engine hood.

## **Battery Cable**

Connect the negative (-) cable to the battery terminal.



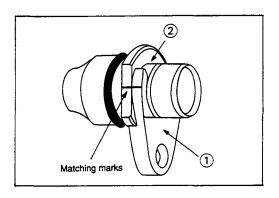
# **EXTERAL COMPONENTS**



#### 2201 V002

- 1. Speedometer sensor and speedometer driven gear
- 2. Transfer flange
- ▲ 3. Front cover with oil seal
- 4. Counter gear snap ring

- ▲ 5. Bearing snap ring
  - 6. Gear control box assembly7. Transfer rear case assmbly
  - 8. Transmission and transfer case assembly

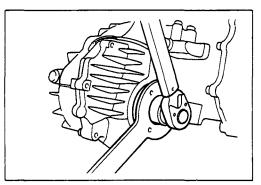




# **Important Operations**

# 1. Speedometer Sensor and Speedometer Driven Gear

Mark the plate 1 and bush 2 alignment for reassembly.

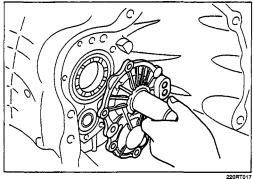




# 2. Transfer Flange

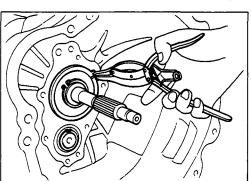
Use the transfer flange holder to remove the transfer flange.

Transfer Flange Holder: 5-8840-2157-0 (J-37221)



#### 3. Front Cover with Oil Seal

Remove the front cover with oil seal from the transmission case.

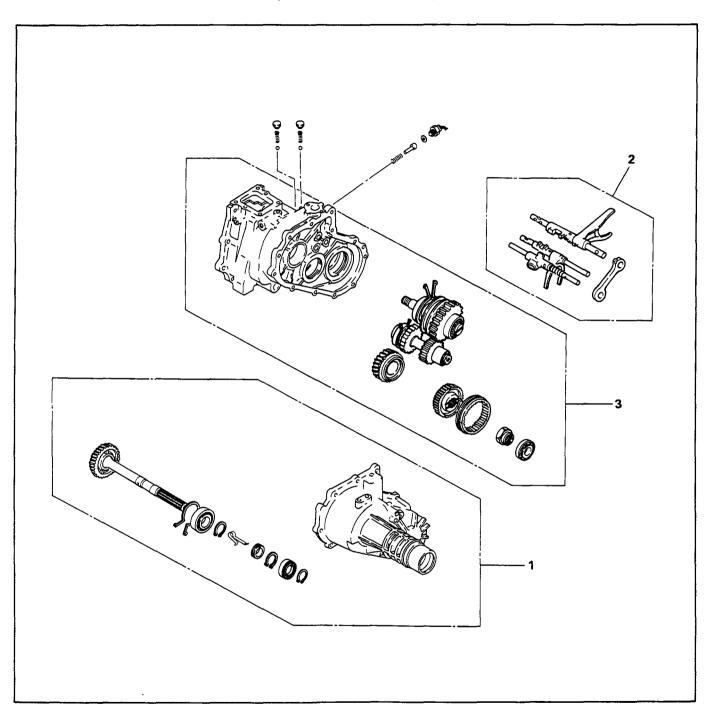


# 4. Counter Gear Snap Ring

# 5. Bearing Snap Ring

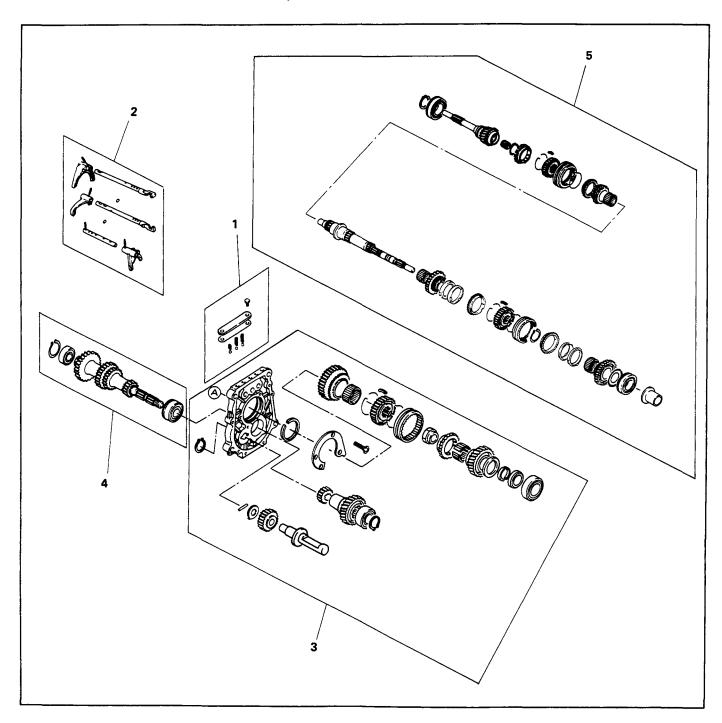
Use a pair of snap ring pliers to remove the snap ring.

# 'MAJOR COMPONENT (TRANSFER CASE)



- 1 Transfer rear case assembly
- 2. Shift fork assembly & interlock pin & detent assembly
- 3. Transfer case assembly

# MAJOR COMPONENT (TRANSMISSION)

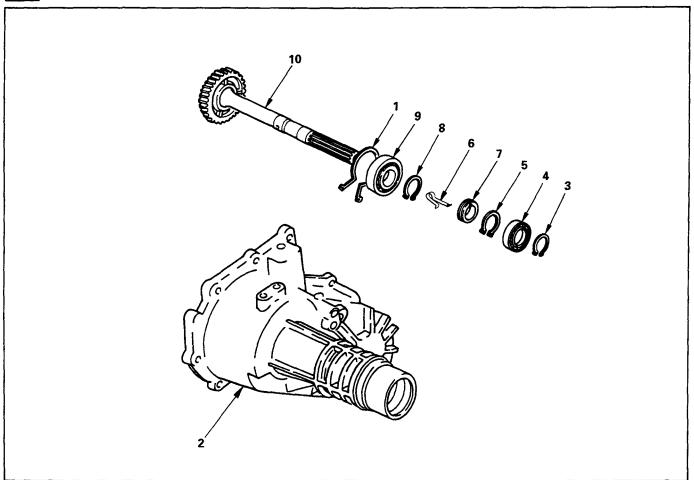


- 1 Detent assembly
- 2. Shift fork assembly & interlock pin
- 3. Rev. and 5th gear assembly
- 4. Counter gear shaft assembly
- 5. Top & main gear shaft assembly

# **MINOR COMPONENT**

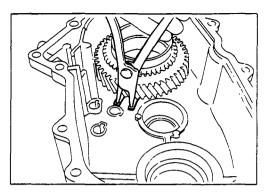


## TRANSFER REAR CASE ASSEMBLY



- ▲ 1. Bearing snap ring
  - 2. Transfer rear case
  - 3. Bearing snap ring
- ▲ 4. Ball bearing
  - 5. Bearing snap ring

- 6. Clip
- 7. Speedometer drive gear
- 8. Bearing snap ring
- 9. Ball bearing
  - 10. Rear output shaft



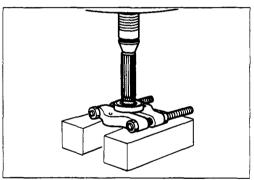


# **Important Operations**



# 1. Bearing Snap Ring

Use a pair of snap ring pliers to remove the snap ring.

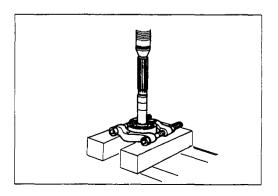




# 4. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)



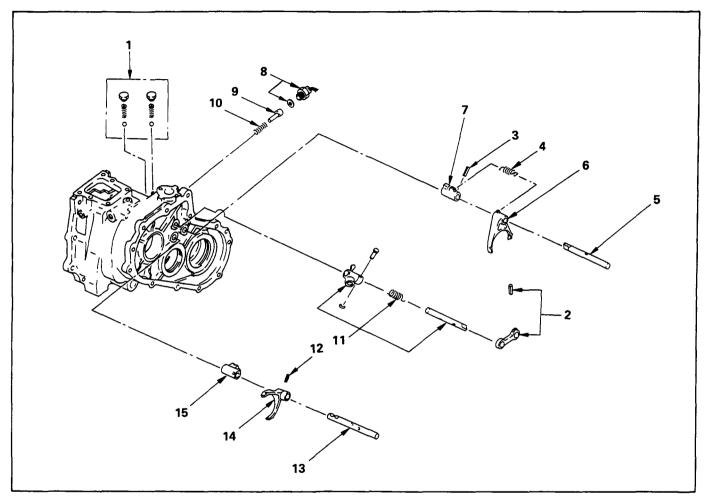


# 9. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

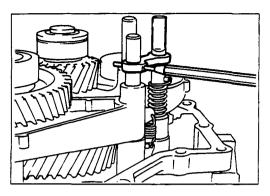


# DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN



- 1. Detent ball, spring and plug
- ▲ 2. Pin and bridge
  - 3. Pin
  - 4. Spring
- ▲ 5. 2WD-4WD shift rod
  - 6. Shift arm
  - 7. Shift block
  - 8. 4WD indicator switch

- ▲ 9. Interlock pin
  - 10. Spring
  - 11. Select rod assembly
  - 12. Pin
- ▲ 13. High-low shift rod
  - 14. Shift arm
  - 15. Shift block



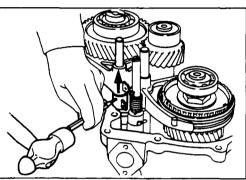


# **Important Operations**



# 2. Bridge

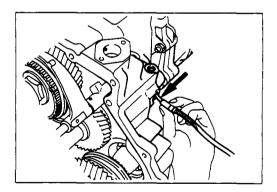
Use a spring pin remover to remove the spring from the bridge.





#### 5. 2WD-4WD Shift Rod

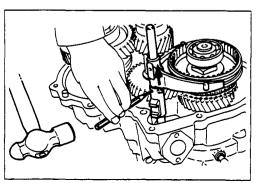
- 1) Engage the 2nd-4th sleeve with the front output gear.
- 2) Remove the spring pin from the block.
- 3) Remove the shift rod.





## 9. Interlock Pin

Use a magnetic tool to remove the interlock pin from the transfer case.



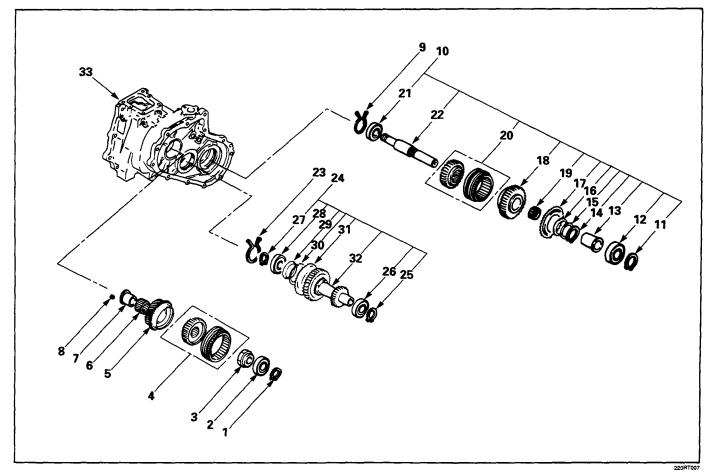


# 13. High-Low Shift Rod

Use a spring pin remover to remove the shift arm spring from the shift arm and the shift rod.

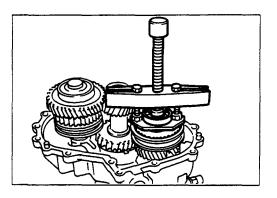


# TRANSFER CASE ASSEMBLY AND MAINSHAFT GEAR



- 1. Bearing snap ring
- 2. Mainshaft end ball bearing
- 3. Mainshaft end lock nut
- 4. High-low clutch hub and sleeve
- ▲ 5. Transfer input gear
  - 6. Needle bearing
- ▲ 7. Bearing collar
  - 8. Ball
- ▲ 9. Bearing snap ring
  - 10. Front output gear assembly
  - 11. Bearing snap ring
- ▲ 12. Ball bearing
  - 13. Bearing collar
- ▲ 14. Anti-lash plate snap ring
  - 15. Spacer
  - 16. Belleville spring
  - 17. Sub gear (Anti-lash plate)

- 18. Front output gear
- 19. Needle bearing
- 20. Clutch hub and sleeve
- ▲ 21. Ball bearing
  - 22. Front output shaft
  - 23. Bearing snap ring
  - 24. Counter gear assembly
  - 25. Bearing snap ring
- ▲ 26. Ball bearing
  - 27. Bearing snap ring
- ▲ 28. Ball bearing
  - 29. Spacer
  - 30. Belleville spring
  - 31. Sub gear (Anti-lash plate)
  - 32. Counter gear
  - 33. Transfer case





# **Important Operations**

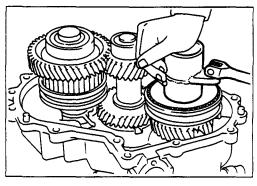


# 2. Mainshaft End Ball Bearing

Use a bearing remover to remove the ball bearing.

Remover: 5-8840-2155-0 (J-37217)

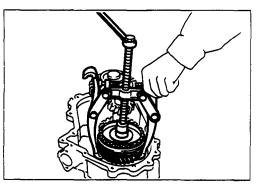
Puller : 5-8840-2027-0





#### 3. Mainshaft End Lock Nut

- 1) Engage the 3rd-top synchronizer with the 3rd gear.
- 2) Engage the low-2nd synchronizer with the low gear.
- 3) Use the lock nut wrench to remove the lock nut. Lock Nut Wrench: 5-8840-2156-0 (J-37219)

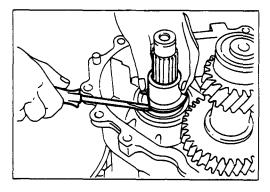




## 4. High-Low Clutch Hub and Sleeve

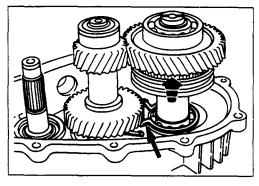
## 5. Transfer Input Gear

Use the universal puller to remove the high-low synchronizer assembly, the high-low block ring, and the transfer input gear.



## 7. 8. Bearing Collar and Ball

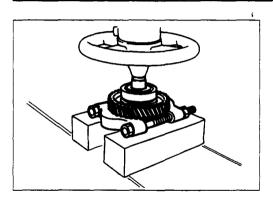
Using screw driver to remove the bearing collar.





#### 9. Bearing Snap Ring

Use a pair of snap ring pliers to expand the bearing snap ring. Use a plastic hammer to tap the front output gear assembly free.

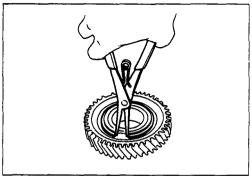




## 12. Ball Bearing

Use a bench press and the ball bearing remover to remove the ball bearing.

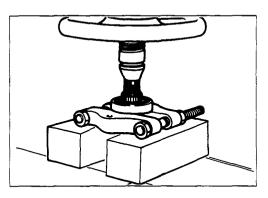
Bearing Remover: 5-8840-0015-0 (J-22912-01)





# 14. Anti-lash Plate Snap Ring

Use a pair of pliers to remove the snap ring.

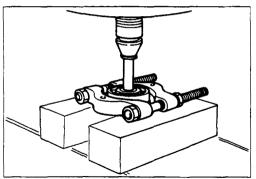




# 21. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)





# 26. Ball Bearing

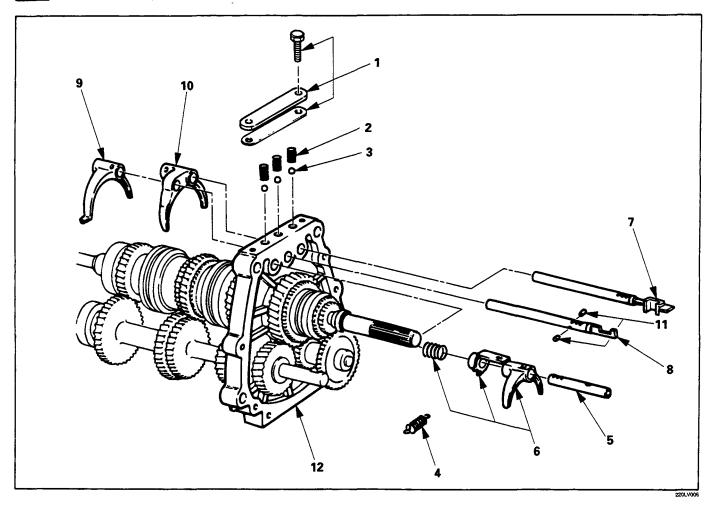
# 28. Ball Bearing

Use a bench press and the bearing remover to remove the ball bearings.

## MINOR COMPONENT

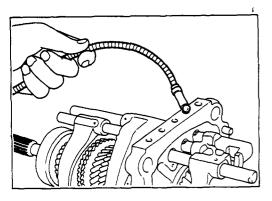


# INTERMEDIATE PLATE AND GEAR ASSEMBLY, DETENT, SHIFT ARM ASSEMBLY, AND INTERLOCK PIN



- 1. Detent spring plate and gasket
- 2. Detent spring
- ▲ 3. Detent ball
  - 4. Spring
  - 5. Rev-5th shift rod
  - 6. Rev-5th shift arm and reverse inhibitor

- 7. 1st-2nd shift rod
- ▲ 8. 3rd-4th shift rod
- ▲ 9. 3rd-4th shift arm
- ▲ 10. 1st-2nd shift arm
- ▲ 11. Interlock pin
  - 12. Intermediate plate and gear assembly





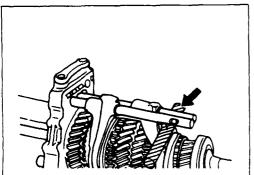
# **Important Operations**



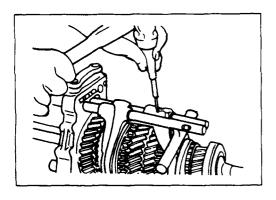
#### 3. Detent Ball

Use a magnetic tool to remove the detent balls from the intermediate plate.

Take care not to lose the detent balls.



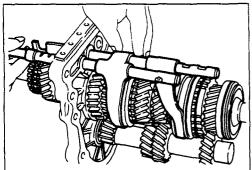
- 8. 3rd-4th Shift Rod
- 9. 3rd-4th Shift Arm
- 10. 1st-2nd Shift Arm
  - Hold a round bar against the shift arm end.
     This will prevent damage to other components.





- Use a spring pin remover to remove the shift arm spring pin from the shift arm and the shift rod.
   Discard the used spring pin.
- 3) Move the 3rd-4th shift rod forward.

  Take care not to lose the interlock pins.



#### 11. Interlock Pin

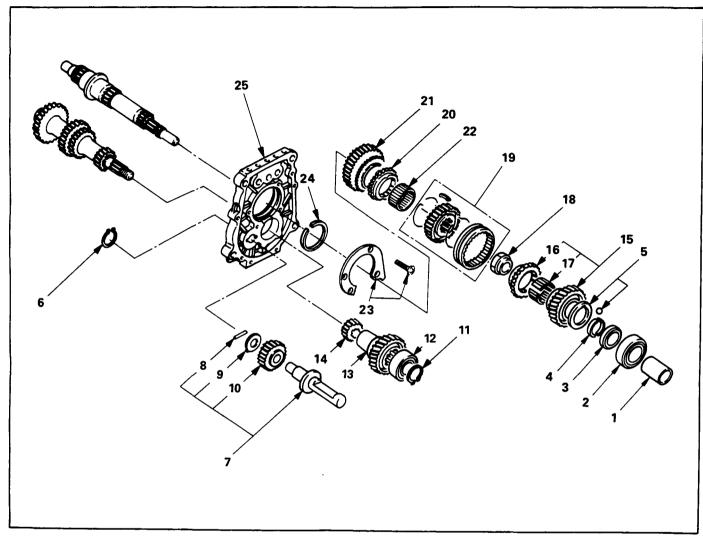
Carefully remove the reverse shifter rod forward to avoid losing the interlock pins.

#### Note:

Remove the shifter rods carefully. Interlock pins are located between the shifter rod in the intermediate plate.

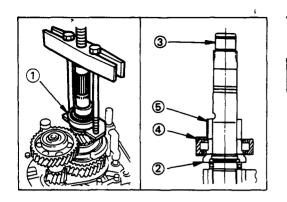


## **REVERSE GEAR AND 5TH GEAR**



- ▲ 1. Oil seal collar
- ▲ 2. Bearing
- ▲ 3. Retainer
  - 4. Thrust plate
  - 5. Thrust washer and lock ball
- ▲ 6. Reverse idler gear snap ring
  - 7. Reverse idler shaft
  - 8. Idle shaft pin
  - 9. Thrust washer
  - 10. Reverse idler gear
  - 11. Bearing snap ring
- ▲ 12. Ball bearing
- ▲ 13. Counter 5th gear

- 14. Counter reverse gear
- 15. 5th gear
- 16. 5th block ring
- ▲ 17. Needle bearing
- ▲ 18. Clutch hub nut
- ▲ 19. Rev-5th synchronizer assembly
- ▲ 20. Reverse block ring
- ▲ 21. Reverse gear
  - 22. Needle bearing
- ▲ 23. Bearing plate and screw
- ▲ 24. Bearing snap ring
- ▲ 25. Intermediate plate





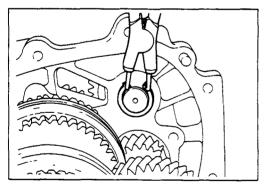
# **Important Operations**

- 1. Oil Seal Collar
- 2. Bearing
- 3. Retainer
- 1) Set the retaining ring remover ① to the retainer ② and the mainshaft end ③.
- 2) Remove the retainer together with the bearing 4 and the oil seal collar 5.

The universal puller may be used in place of the retaining ring remover.

Retainer Remover: 5-8840-2158-0 (J-37222)

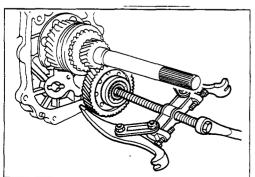
Universal Puller: 5-8840-2027-0





# 6. Reverse Idler Gear Snap Ring

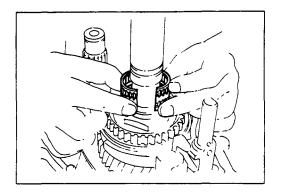
Use a pair of snap ring pliers to remove the snap ring.





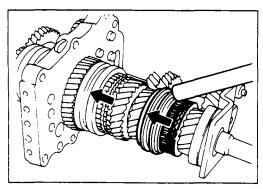
- 12. Ball Bearing
- 13. Counter 5th Gear

Use the bearing remover to remove the ball bearing.



### 17. Needle Bearing

Remove the needle bearing (2 piece type).

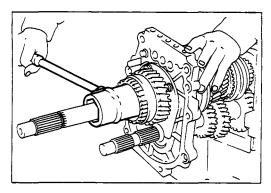


# **Q**

#### 18. Clutch Hub Nut

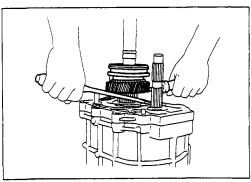
- 1) Engage the 3rd-4th synchronizer with the 3rd gear.
- 2) Engage the 1st-2nd synchronizer with the 1st gear.
- 3) Attach the holding fixture together with the holding base to the mainshaft front bearing and the counter gear front bearing.

Holding Fixture: 5-8840-2160-0 (J-37224) Holding Base: 5-8840-0003-0 (J-3289-20)





4) Use the hub nut wrench to remove the hub nut. Hub Nut Wrench: 5-8840-2156-0 (J-37219)

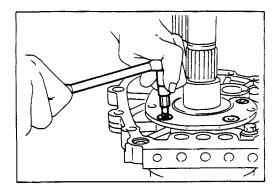


#### 19. Rev.-5th Synchronizer Assembly

#### 20. Reverse Ring

#### 21. Reverse Gear

Use screw drivers between the reverse gear and bearing plate to remove the Rev.-5th synchronizer assembly together with reverse ring and gear.

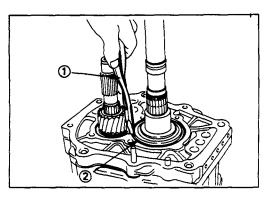




#### 23. Bearing Plate and Screw

Use the Torx bit to remove the bearing plate screw from the intermediate plate.

Torx Bit Wrench: 5-8840-0047-0 (J-37225) (T45)





# 24. Ball Bearing Snap Ring

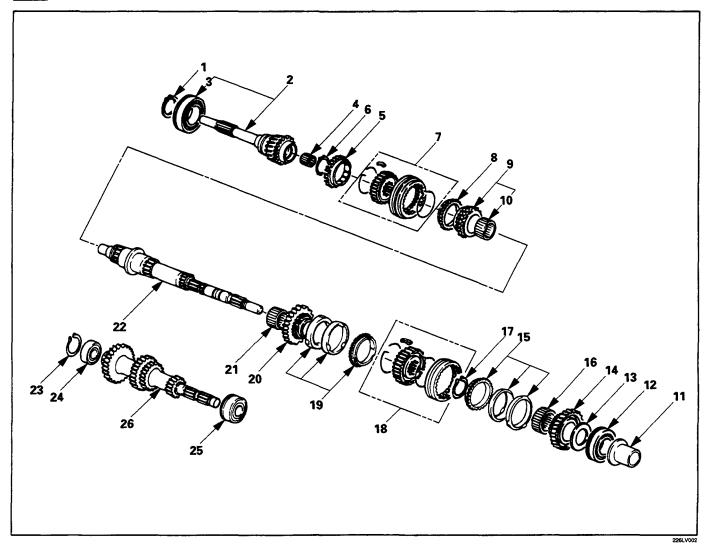
#### 25. Intermediate Plate

- Insert the snap ring pliers into the mainshaft bearing snap ring hole.
- 2) Use the snap ring pliers ① to force open the main-shaft bearing snap ring ②.
  - Hold the snap ring open with the pliers.
- 3) Push the intermediate plate toward the rear of the transmission to remove it.

The ball bearing snap ring will come free.

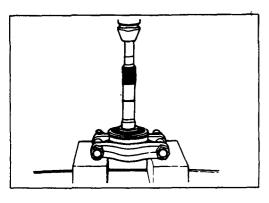


# TOP GEAR SHAFT, MAIN GEAR SHAFT, AND COUNTER GEAR



- 1. Top gear shaft snap ring
- 2. Top gear shaft
- ▲ 3. Top gear ball bearing
  - 4. Needle bearing
  - 5. Top block ring
- ▲ 6. Mainshaft snap ring
- ▲ 7. 3rd-4th synchronizer assembly
  - 8. 3rd block ring
  - 9. 3rd gear
  - 10. Needle bearing
- ▲ 11. Needle bearing collar
- ▲ 12. Mainshaft ball bearing
- ▲ 13. 1st gear thrust bearing

- ▲ 14. 1st gear
- 15. 1st block ring (set)
- 16. Needle bearing
- ▲ 17. Clutch hub snap ring
- ▲ 18. 1st-2nd synchronizer assembly
- ▲ 19. 2nd block ring (set)
- ▲ 20. 2nd gear
  - 21. Needle bearing
  - 22. Mainshaft
  - 23. Bearing snap ring
- ▲ 24. Counter gear front bearing
  - 25. Counter gear center bearing
  - 26. Counter gear



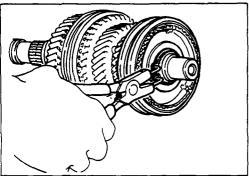


# **Important Operations**

# 3. Top Gear Ball Bearing

Use a bench press and the bearing remover to remove the ball bearing.

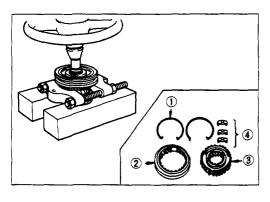
Bearing Remover: 5-8840-0015-0 (J-22912-01)





## 6. Mainshaft Snap Ring

Use a pair of snap ring pliers to remove the snap ring.





#### 7. 3rd-4th Synchronizer Assembly

- 1) Use a bench press and the bearing replacer to remove the synchronizer assembly as a set.
- 2) Disassemble the synchronizer assembly.
  - (1) Springs
  - ② Sleeve
  - 3 Clutch Hub
  - 4 Inserts

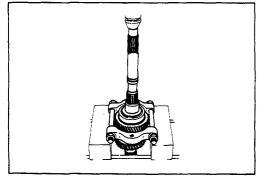
#### Note:

Mark the hub and sleeve alignment for reassembly.



- 11. Needle Bearing Collar
- 12. Mainshaft Ball Bearing
- 13. 1st Gear Thrust Bearing
- 14. 1st Gear

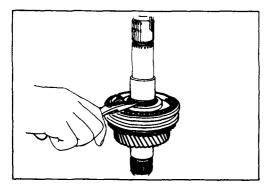
Use a bench press and the bearing remover to remove the ball bearing.

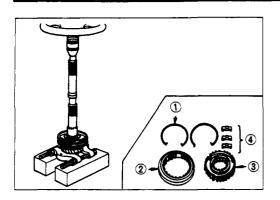




# 17. Clutch Hub Snap Ring

Use a pair of snap ring pliers to remove the snap ring.







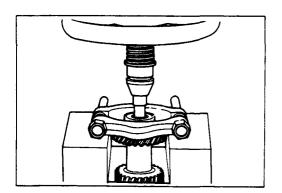
- 18. 1st-2nd Synchronizer Assembly
- 19. 2nd Block Ring (Set)
- 20. 2nd Gear
  - Use a bench press and the bearing remover to remove the ball bearing 2nd gear together with synchronizer assembly.

Remover: 5-8840-0015-0 (J-22912-01)

- 2) Disassemble the synchronizer assembly.
  - Springs
  - ② Sleeve③ Clutch Hub
  - (4) Inserts

#### Note:

Mark the hub and sleeve alignment for reassembly.





# 24. Counter Gear Front Bearing

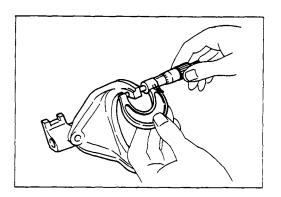
Use a bench press and the bearing remover to remove the bearing.

Bearing Remover: 5-8840-0015-0 (J-22912-01)



# **INSPECTION AND REPAIR**

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



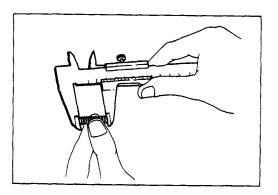


#### SHIFT ARM THICKNESS

Use a micrometer to measure the shift arm thickness.

If the measured value is less than the specified limit, the shift arm must be replaced.

Shift Arm Thickness		mm(in)
	Standard	Limit
1st-2nd Transfer 4x4/4x2 High/Low	9.60–9.85 (0.378–0.388)	9.0 (0.354)
3rd-4th Rev5th	9.60–9.80 (0.378–0.386)	





# DETENT AND INTERLOCK SPRINGS FREE LENGTH

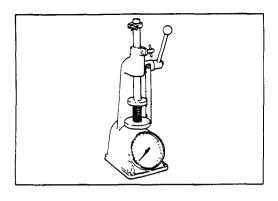
Springs Free Length

Use a venier caliper to measure the springs free length.

If the measured value is less than the specified limit, the springs must be replaced.

mm(in)

		Standard	Limit	
(Detect Bell)	Transmission	26.8 (1.06)	26.2 (1.03)	
(Detent Ball)	Transfer case	23.4 (0.92)	22.8 (0.90)	
(Interlock Pin)	Transfer case	1.59 (0.063)	1.53 (0.060)	

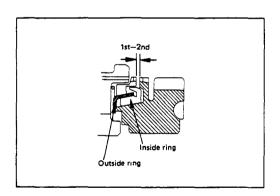




# **DETENT SPRING TENSION**

Use a spring tester to measure the springs tension. If the measured value is less than the specified standard, the springs must be replaced.

Springs Tension			kg(lb/N)
		Compressed Height	Standard
(Detent Ball)	Transmission	20 mm (0.787 in)	8.9—9.9 (19.6—21.8/ 87.2—97)
	Transfer case	18.7 mm (0.736 in)	7.0—9.0 (15.4—19.8/ 68.7—88.3)
(Interlock Pin)	Transfer case	11.5 mm (0.453 in)	1.0 (2.2/9.8)



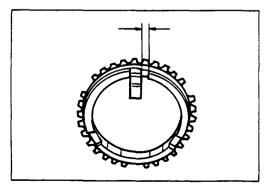


# **BLOCK RING AND DOG TEETH CLEARANCE**

Use a thickness gauge to measure the clearance between the block ring and the dog teeth.

If the measured value exceeds the specified limit, the block ring must be replaced.

Block Ring and Dog Teeth Clearance		
Standard	Limit	
1.5 (0.059)	0.8 (0.032)	



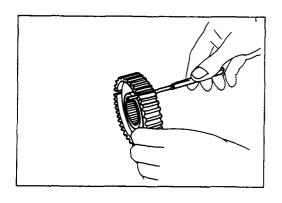


# **BLOCK RING AND INSERT CLEARANCE**

Use a vernier caliper to measure the clearance between the block ring and the insert.

If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

ock Ring and Insert Clearance		mm(in)	
	Standard	Limit	
3rd-4th	3.46-3.74 (0.136-0.147)	4.0 (0.158)	
1st-2nd Transfer	4.34-4.66 (0.171-0.183)	4.9 (0.193)	
Rev5th	3.59-3.91 (0.141-0.154)	4.1 (0.161)	



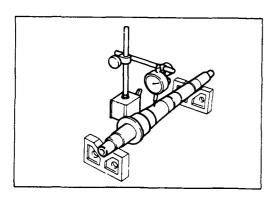


## **CLUTCH HUB AND INSERT CLEARANCE**

Use a thickness gauge to measure the clearance between the clutch hub and the insert.

If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

lutch Hub and Insert Clearance		mm(ir	
	Standard	Limit	
3rd-4th	0.01-0.19 (0.0004-0.0075)	0.3 (0.012)	
1st-2nd Rev5th	0.09-0.31 (0.0035-0.0122)	0.4 (0.016)	



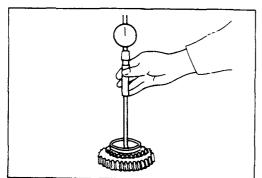


#### **MAINSHAFT RUN-OUT**

- 1. Install the mainshaft to a grinding machine.
- 2. Use a dial indicator to measure the mainshaft central portion run-out.

If the measured mainshaft run-out exceeds the specified limit, the mainshaft must be replaced.

Mainshaft Run Out		mm(in)	
	Limit		
	0.05 (0.0020)		





#### **GEAR INSIDE DIAMETER**

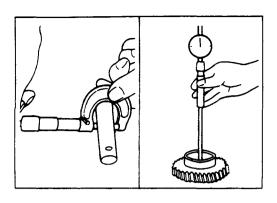
Use an inside dial indicator to measure the gear inside diameter.

If the measured value is less than the specified limit, the gear must be replaced.

Gear	Inside	Diameter

mm	

Gear Inside Diameter		mm(in)	
	Standard	Limit	
1st 3rd	45.000-45.013 (1.771-1.772)	45.100 (1.776)	
2nd	52.000-52.013 (2.047-2.048)	52.100 (2.051)	
Rev. Transfer	48.000-48.013 (1.889-1.890)	48.100 (1.894)	
5th	32.000-32.013 (1.259-1.260)	32.100 (1.264)	



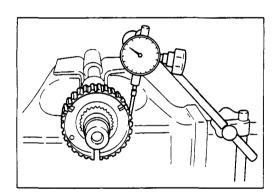


# REVERSE IDLER GEAR AND IDLER GEAR SHAFT CLEARANCE

- 1. Use a micrometer to measure the idler gear shaft diameter.
- 2. Use an inside dial indicator to measure the idler gear inside diameter.
- Calculate the idler gear and idler gear shaft clearance.
   Idler gear inside diameter idler gear shaft diameter = idler gear and idler gear shaft clearance.

If the measured value exceeds the specified limit, the idler gear and/or the idler gear shaft must be replaced.

Idler Gear and Idler Gear Shaft Clearance mm(i	
Standard	Limit
0.041 - 0.074 (0.0016 - 0.0029)	0.150 (0.0059)





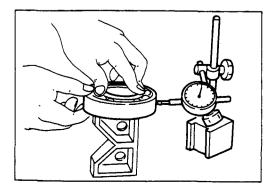
#### **CLUTCH HUB SPLINE PLAY**

- 1. Set a dial indicator to the clutch hub to be measured.
- 2. Move the clutch hub as far as possible to both the right and the left.

Note the dial indicator reading.

It the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch Hub Spl	mm(in)	
	Standard	Limit
1st—2nd		
3rd—4th		
Transfer	0 — 0.1 (0 — 0.0039)	0.2 (0.0079)
4×2/4×4		
High/Low		
Rev.—5th	0 - 0.2 (0 - 0.0079)	0.3 (0.0118)





#### **BALL BEARING PLAY**

Use a dial indicator to measure the ball bearing play.

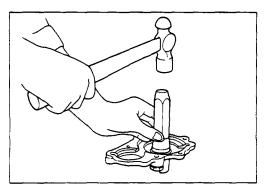
Ball Bearing Play	mm(in)
Limit	
0.2 (0.0079)	



# FRONT COVER OIL SEAL Oil Seal Replacement

#### Oil Seal Removal

Use a screwdriver to pry the oil seal from the front cover.





## Oil Seal Installation

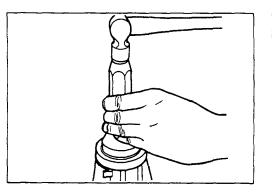
1. Use the oil seal installer to install the oil seal to the front cover.

Oil Seal Installer: 5-8840-0026-0 (J-26540)

2. Apply gear oil to the oil seal lip.



Use a screwdriver to pry the oil seal from the rear cover.







#### Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the rear cover.

Oil Seal Installer: 5-8522-0050 (J-29769)

2. Apply engine oil to the oil seal lip.

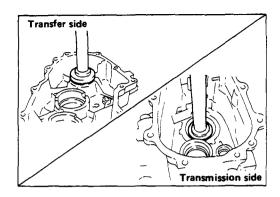


## TRANSFER CASE MAINSHAFT OIL SEAL

Oil Seal Replacement

#### Oil Seal Removal

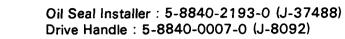
Use a screwdriver to pry the oil seal from the transfer case.





## Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the transfer case.



2. Apply engine oil to the oil seal lip.

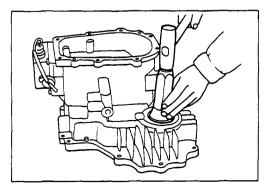


# TRANSFER CASE FRONT OUTPUT SHAFT OIL SEAL

## Oil Seal Replacement

#### **Oil Seal Removal**

Use a screwdriver to pry the oil seal from the transfer case.





#### Oil Seal Installation

1. Use the oil seal installer to install the oil seal to the transfer case.

Oil Seal Installer: 5-8840-2161-0 (J-37226)

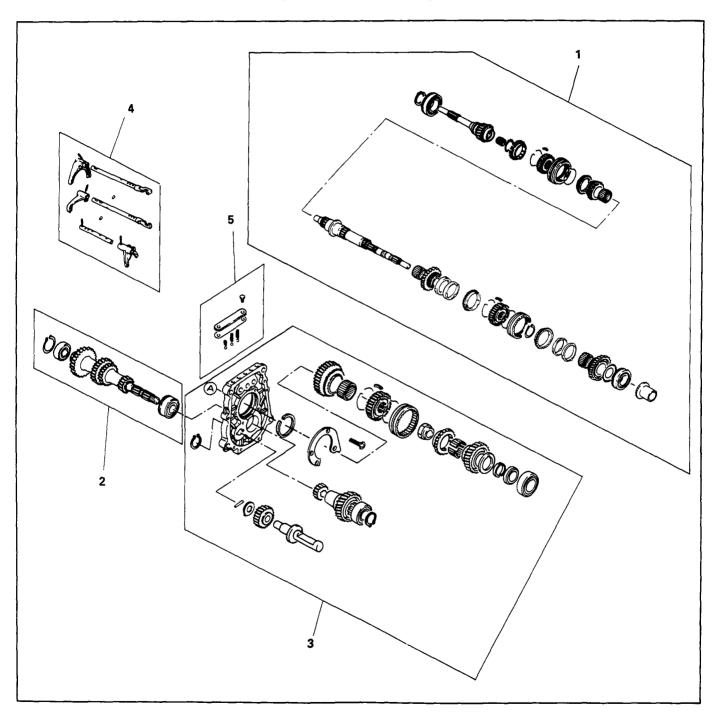
2. Apply engine oil to the oil seal lip.





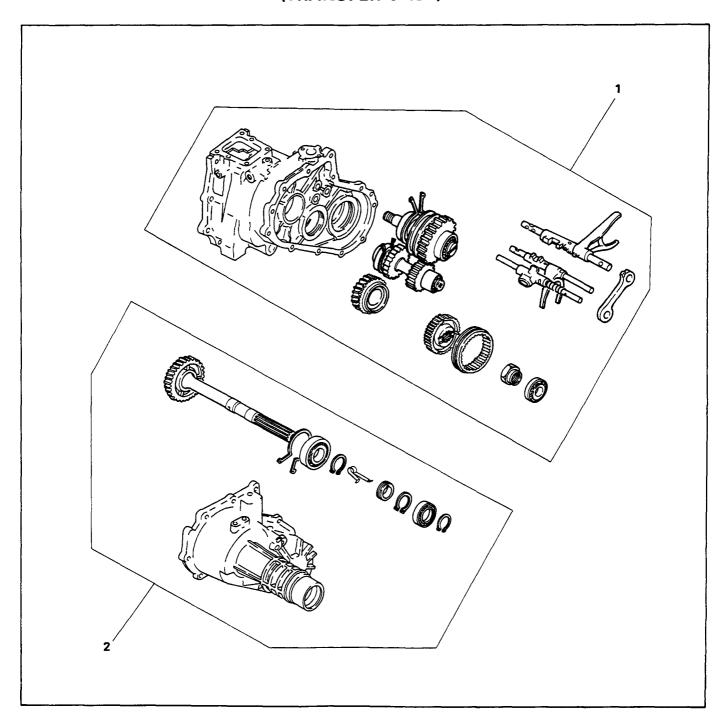
## **REASSEMBLY**

# MAJOR COMPONENT (TRANSMISSION)



- 1 Top & main gear shaft assembly
- 2. Counter gear shaft assembly
- 3. Rev. and 5th gear assembly
- 4. Shift arm assembly & interlock pin
- 5. Detent assembly

# MAJOR COMPONENT (TRANSFER CASE)

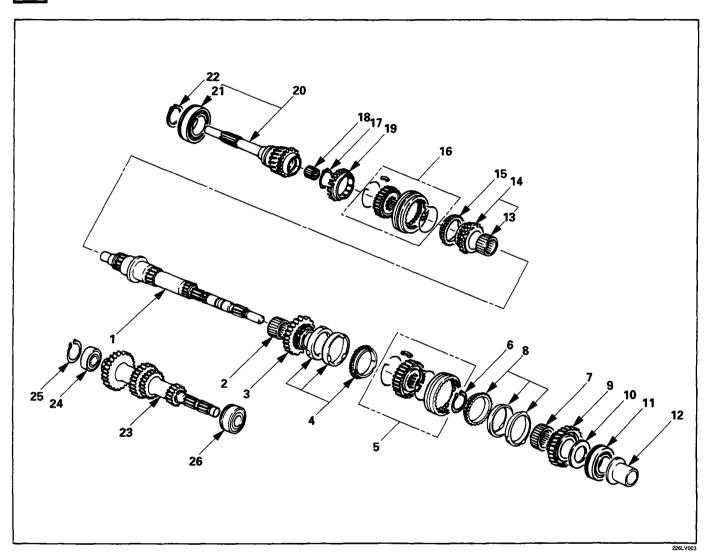


- 1 Transfer case assembly
- 2. Transfer rear case assembly

## 'MINOR COMPONENT (TRANSMISSION)

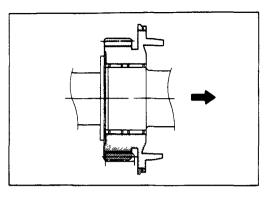


## INTERMEDIATE PLATE AND GEAR ASSEMBLY TOP GEAR SHAFT, MAIN SHAFT GEAR AND COUNTER GEAR



- 1. Mainshaft
- ▲ 2. Needle bearing
- ▲ 3. 2nd gear
  - 4. 2nd block ring (set)
- ▲ 5. 1st—2nd synchronizer assembly
- ▲ 6. Clutch hub snap ring
- ▲ 7. Needle bearing
  - 8. 1st block ring (set)
- ▲ 9. 1st gear
- ▲ 10. 1st gear thrust bearing
- ▲ 11. Mainshaft ball bearing
- ▲ 12. Needle bearing collar
- ▲ 13. Needle bearing

- ▲ 14. 3rd gear
  - 15. 3rd block ring
- ▲ 16. 3rd—4th synchronizer assembly
- ▲ 17. Mainshaft snap ring
  - 18. Needle bearing
  - 19. Top block ring
  - 20. Top gear shaft
- ▲21. Ball bearing
- ▲ 22. Top gear shaft snap ring
  - 23. Counter gear
- ▲ 24. Counter gear front bearing
  - 25. Snap ring
  - 26. Counter gear center bearing



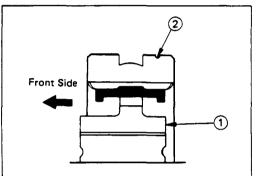


#### 2. Needle Bearing

#### 3. 2nd Gear

- 1) Apply engine oil to the needle bearing and the 2nd gear thrust surfaces.
- 2) Install the needle bearing and the 2nd gear to the mainshaft.

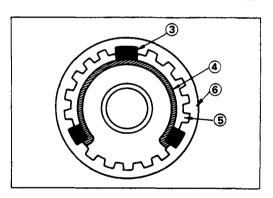
The dog teeth of the 2nd gear must be facing the rear side of the transmission.





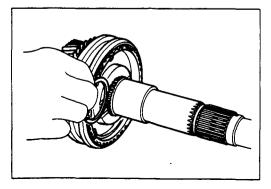
## 5. 1st-2nd Synchronizer Assembly

1) Turn the shallow clutch hub face ① toward the side of the sleeve with small groove ② on the outer circumference.





- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs 4 are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub (5) and the sleeve (6) slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft. The clutch hub face (with the heavy boss) must be facing the 2nd gear side.





## 6. Clutch Hub Snap Ring

 Select the snap ring which will provide the minimum clearance between the 1st/2nd clutch hub and the snap ring.

There are three snap ring sizes available.

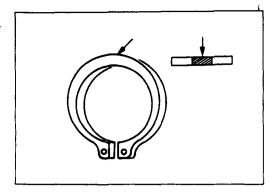
The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance

mm(in)

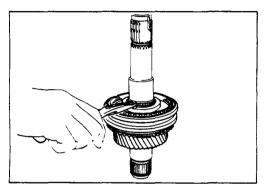
Standard

0 - 0.1 (0.0039)



## Snap Ring Avalilability

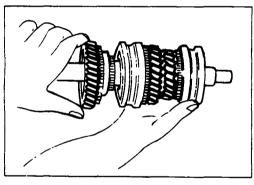
Thickness mm(in)	Color-Coding
1.80 (0.071)	White
1.85 (0.073)	Yellow
1.90 (0.075)	Blue





2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

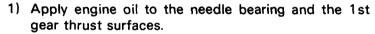
The snap ring must be fully inserted into the mainshaft snap ring groove.





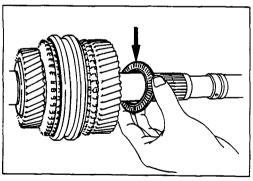
#### 7. Needle Bearing

9. 1st Gear



2) Install the needle bearing and the 1st gear to the mainshaft.

The 1st gear dog teeth must be facing the transmission front side.

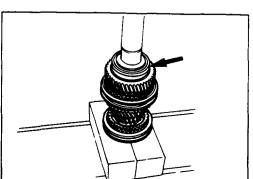




## 10. 1st Gear Thrust Bearing

Install the thrust bearing to the mainshaft.

The thrust bearing side must be facing the transmission front side.





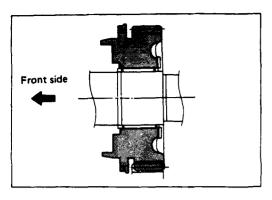
#### 11. Mainshaft Ball Bearing

#### 12. Needle Bearing Collar



- Apply engine oil to the ball bearing and the mainshaft.
- Install the ball bearing and collar to the mainshaft.
   The ball bearing snap ring groove must be facing the transmission rear side.
- 3) Use a bench press to slowly force the collar into place.

Installer: 5-8840-2195-0 (J-6133-01)



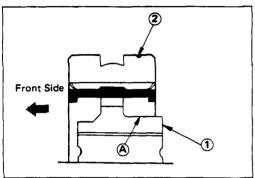


## 13. Needle Bearing

#### 14. 3rd Gear

- 1) Apply engine oil to the needle bearing and the 3rd gear thrust surfaces.
- 2) Install the needle bearing and the 3rd gear to the mainshaft.

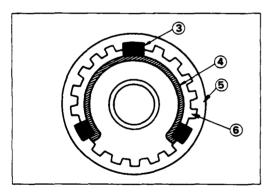
The dog teeth of the 3rd gear must be facing the front side of the transmission.





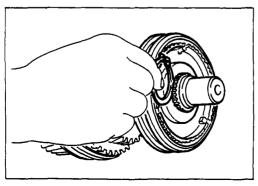
## 16. 3rd-4th Synchronizer Assembly

1) Turn the clutch hub face ① with the heavy boss A toward the side of the sleeve with small groove ② on the outer circumference.





- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs 4 are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub (5) and the sleeve (6) slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft. The clutch hub face (with the heavy boss) must be facing the 3rd gear side.





## 17. Mainshaft Snap Ring

1) Select the snap ring which will provide the minimum clearance between the 3rd-4th clutch hub and the snap ring.

There are three snap ring sizes available.

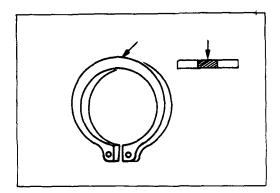
The snap rings are color-coded to indicate their thickness.

Clutch Hub and Snap Ring Clearance

mm(in)

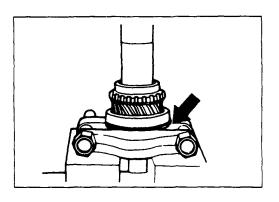
Standard

0 - 0.1 (0.0039)



Snap Ring Availability	mm(in)
Thickness	Color-Coding
1.80 (0.071)	White
1.85 (0.073)	Yellow
1.90 (0.075)	Blue

- 2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.
- 3) The snap ring must be fully inserted into the mainshaft snap ring groove.





## 21. Ball Bearing

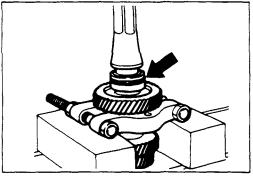
#### 22. Top Gear Shaft Snap Ring



1) Use a bench press to install the top gear shaft ball bearing to the mainshaft.

The snap ring groove must be facing the transmission front side.

2) Use a pair of snap ring pliers to install the snap ring to the bearing.



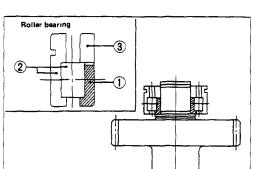


## 24. Counter Gear Front Bearing

Use a bench press to install the counter gear front ball bearing to the mainshaft.

The snap ring groove must be facing the transmission front side.

Bearing installer: 5-8840-2194-0 (J-35283)





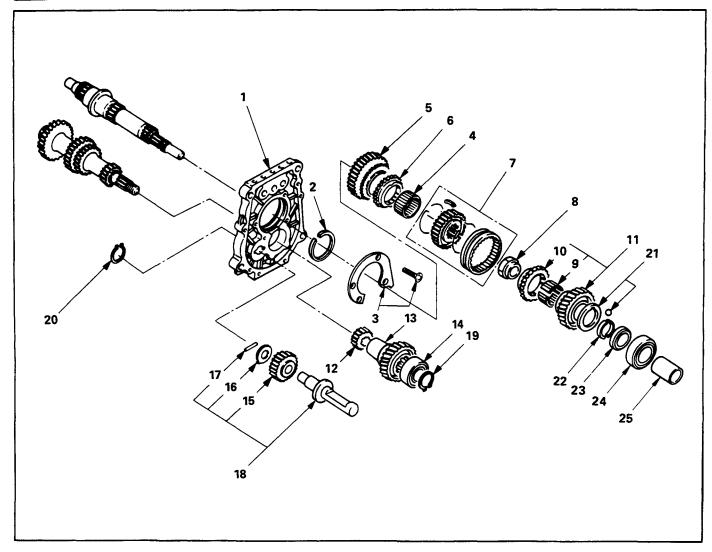
- 1) Apply engine oil to the bearing and install the inner race ① and outer race with roller ② in the proper direction to the mainshaft.
- 2) Then install the inner race ③ with taper side turned to outer race ②.

#### Note:

The inner race ③ should be installed with stamp on die face side turned to the front side of transmission.

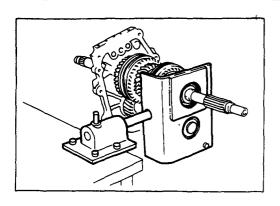


## **REVERSE GEAR AND 5TH GEAR**



- ▲ 1. Intermediate plate
  - 2. Bearing snap ring
- ▲ 3. Bearing plate and screw
  - 4. Needle bearing
  - 5. Mainshaft reverse gear
  - 6. Reverse block ring
- ▲ 7. Rev.-5th synchronizer assembly
- ▲ 8. Clutch hub nut
  - 9. Needle bearing
  - 10. 5th block ring
  - 11. 5th gear
- ▲ 12. Counter reverse gear
  - 13. Counter 5th gear

- 14. Ball bearing
- 15. Reverse idler gear
- 16. Thrust washer
- 17. Idler shaft pin
- 18. Reverse idler shaft
- ▲ 19. Bearing snap ring
- ▲ 20. Reverse gear snap ring
- ▲ 21. Thrust washer and lock ball
  - 22. Thrust plate
  - 23. Retainer
- ▲ 24. Roller bearing
  - 25. Oil seal collar



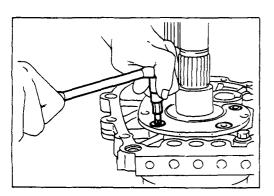


#### 1. Intermediate Plate

- 1) Mesh the counter gear with the mainshaft assembly.
- 2) Install the holding fixture to the mainshaft and the counter gear.

Holding Fixture : 5-8840-2160-0 (J-37224) Holding base : 5-8840-0003-0 (J-3289-20)

- 3) Place the holding fixture (with the mainshaft and the counter shaft) in a vise.
- 4) Install the intermediate plate.







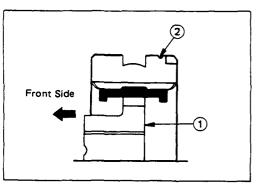




- 1) Apply recommended thread locking agents or its equivalent to each of the plate screw threads.
- 2) Use the wrench to tighten the screws to the specified torque.

Torx Bit Wrench : 5-8840-0047-0 (J-37225) (T45)
Plate Screw Torque kg·m (Ib·ft/N·m)

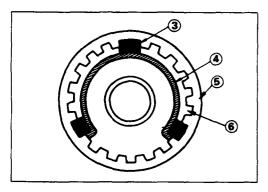
 $1.45 \pm 0.35 (10.5 \pm 2.5/14.2 \pm 3.4)$ 



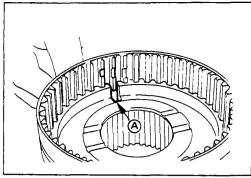


#### 7. Rev.—5th Synchronizer Assembly

 Turn the clutch hub face 1 toward the side of the sleeve with small groove 2 on the outer circumference.



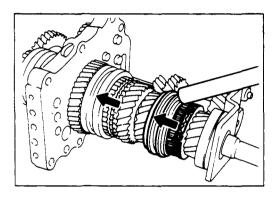
- 2) Check that the inserts ③ fit snugly into the block ring insert grooves.
- 3) Check that the insert springs 4 are fitted to the inserts as shown in the illustration.
- 4) Check that the clutch hub (5) and the sleeve (6) slide smoothly.
- 5) Install the synchronizer assembly to the mainshaft. The clutch hub face (with the heavy boss) must be facing the reverse gear side.





### Note:

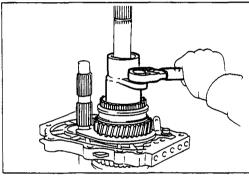
The clutch hub groove (A) must be aligned with the key groove of sleeve.



#### 8. Clutch Hub Nut

1) Mesh the 1st-2nd synchronizer with both the 1st and 3rd gears (double engagement).

This will prevent the mainshaft from turning.





#### 2) Install the mainshaft lock nut.

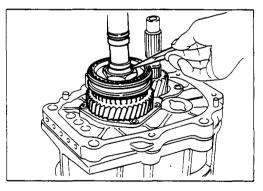
3) Use the lock nut wrench to tighten the lock nut to the specified torque.

Wrench: 5-8840-2156-0 (J-37219)

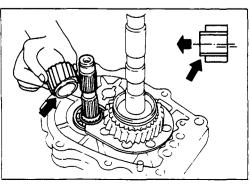
**Hub Nut Torque** 

kg·m(lb.ft/N·m)

 $13 \pm 1 (94.0 \pm 7.2/127.4 \pm 9.8)$ 



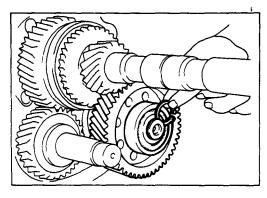
4) Use a punch to stake the lock nut.





#### 12. Counter Reverse Gear

- 1) Apply engine oil to the counter reverse gear and the reverse gear.
- 2) Install the counter reverse gear to the counter gear. The reverse gear projection must be facing the side of the intermediate plate.





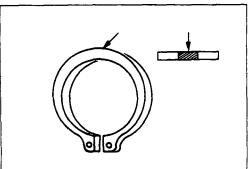
#### 19. Bearing Snap Ring

 Select the snap ring which will provide the minimum clearnance between the ball bearing and the snap ring.

There are six snap ring sizes available.

The snap rings are color-coded to to indicate their thickness.

Ball Bearing and Snap Ring	Clearance mm(in)
Standard	0 - 0.15 (0 - 0.0059)

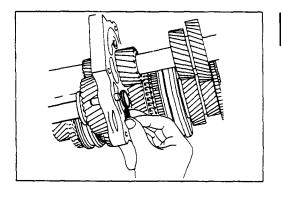




Snap Ring Availability	mm(in)
Thickness mm(in)	Color-Coding
1.1 (0.043)	White
1.2 (0.047)	Yellow
1.3 (0.051)	Blue
1.4 (0.055)	Pink
1.5 (0.059)	Green
1.6 (0.063)	Brown

2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

The snap ring must be fully inserted into the counter 5th gear snap ring groove.





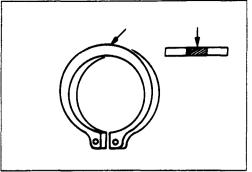
## 20. Reverse Gear Snap Ring

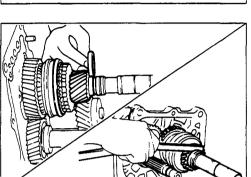
 Select the snap ring which will provide the minimum clearance between the intermediate plate and the snap ring.

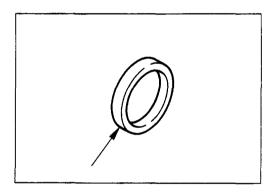
There are three snap ring sizes available.

The snap rings are color-coded to indicate their thickness.

Intermediate Plate and Snap	Ring Clearance	<u>mm</u> (in)
Standard	0 - 0.15 (0 - 0	0.0059)









Snap Ring Availability	mm(in)
Thickness mm(in)	Color-Coding
1.2 (0.047)	White
1.3 (0.051)	Yellow
1.4 (0.055)	Blue

2) Use a pair of snap ring pliers to install the snap ring to the mainshaft.

The snap ring must be fully inserted into the counter 5th gear snap ring groove.



### 21. Thrust Washer and Lock Ball

1) Use a thickness gauge to measure the clearance between the 5th gear and the thrust washer.

5th Gear and Thrust Washer Clearance	mm(in)
Standard	
0.10 - 0.25 (0.0039 - 0.0098)	

If required, replace the exsisting thrust washer with a new thrust washer to bring the clearance to specification.



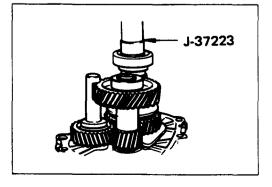
There are four thrust washer sizes available.

The snap rings are color-coded to indicate their thickness.

<b>₽</b>	

Thrust Washer Availability	mm(in)
Thickness	Color-Coding
7.9 (0.311)	White
8.0 (0.315)	Yellow
8.1 (0.319)	Green
8.2 (0.323)	Blue

- 2) Apply grease to the thrust washer and the lock ball.
- 3) Install the thrust washer and the lock ball to the mainshaft.





#### 24. Roller Bearing

Apply engine oil to the bearing inner and outer circumference.

Use the installer to install the roller bearing to the mainshaft. Installer: 5-8840-2159-0 (J-37223)

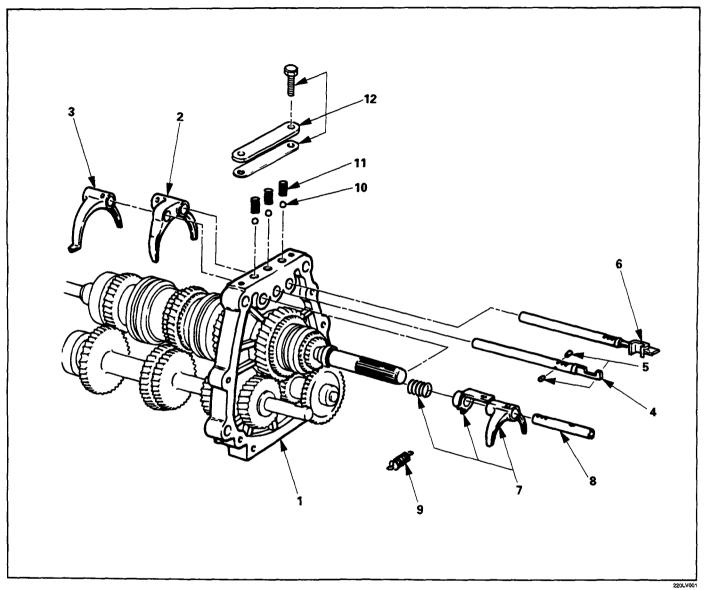
.

#### Note:

Be sure the bearing is installed in the direction it was removed from.

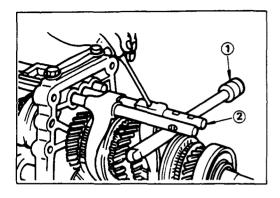


# DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN



- 1. Intermediate plate and gear assembly
- ▲ 2. 1st—2nd shift arm
- ▲ 3. 3rd—4th shift arm
- ▲ 4. 3rd—4th shift rod
- ▲ 5. Interlock pin
  - 6. 1st-2nd shift rod

- 7. Rev. 5th shift arm and inhibiter
- 8. Rev. 5th shift rod
- 9. Spring
- 10. Detent ball
- 11. Detent spring
- ▲ 12. Detent spring plate and gasket





#### 2. 1st-2nd Shift Arm

#### 3. 3rd-4th Shift Arm

Hold a round bar 1 against the shift rod end lower face (2) to protect it against damage.

Install the new spring pin.

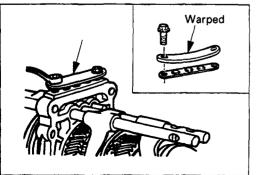
Never reinstall the used spring pin.

#### 4. 3rd-4th Shift Rod

## 5. Interlock pin

- 1) Install the interlock pin to the shift rod.
- 2) Install the shift rod together with the interlock pin to the intermediate plate.

Do not allow the interlock pin to fall from the shift rod.





## 12. Detent Spring Plate and Gasket

- 1) Install the new-detent plate and new gasket onto the transmisson case into the correct direction.
- 2) Tighten the detent spring plate bolts to specified torque.

**Detent Spring Plate Bolt Torque** 

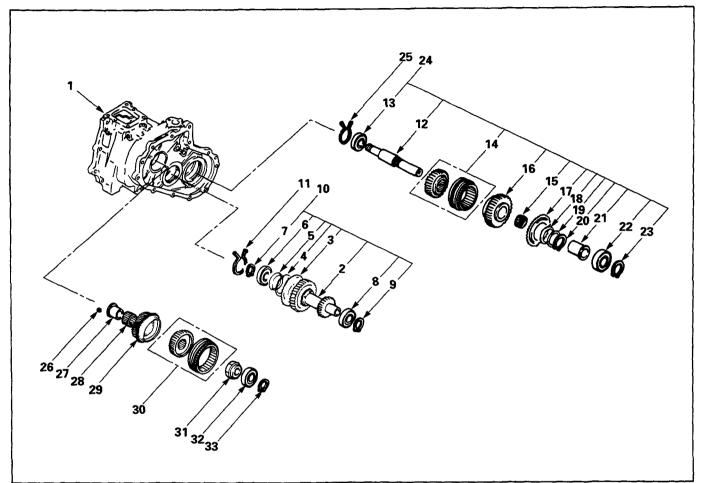
kg·m(lb.ft/N·m)

1.5 (10.8/14.7)

## MINOR COMPONENT

# + +

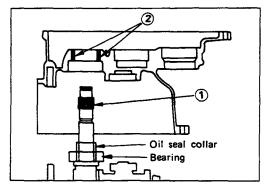
### TRANSFER CASE ASSEMBLY



226LV00

- ▲ 1. Transfer case
- ▲ 2. Counter gear
- ▲ 3. Sub gear (Anti-lash plate)
  - 4. Belleville spring
  - 5. Spacer
  - 6. Ball bearing
- ▲ 7. Snap ring
  - 8. Ball bearing
  - 9. Snap ring
  - 10. Counter gear assembly
  - 11. Bearing snap ring
  - 12. Front output shaft
  - 13. Ball bearing
  - 14. Clutch hub and sleeve
  - 15. Needle bearing
- ▲ 16. Front output gear
- ▲ 17. Sub gear (Anti-lash plate)
- ▲ 18. Belleville spring

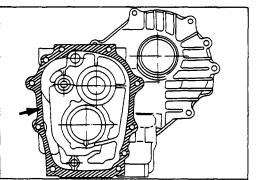
- ▲ 19. Spacer
- ▲ 20. Anti-lash plate snap ring
- ▲ 21. Bearing collar
  - 22. Ball bearing
- ▲ 23. Snap ring
  - 24. Front output gear assembly
  - 25. Bearing snap ring
  - 26. Ball
  - 27. Bearing collar
  - 28. Needle bearing
  - 29. Transfer input gear
- ▲ 30. High-low clutch hub and sleeve
- ▲ 31. Mainshaft end lock nut
- ▲ 32. Ball bearing
  - 33. Snap ring





#### 1. Transfer Case

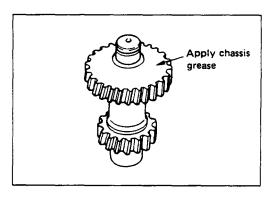
Cover the shaft spline with adhesive tape ①.
 This will prevent damage to the oil seal lip ②.





- 2) Apply recommend liquid gasket or its equivalent to the transfer case fitting surfaces.
- 3) Tighten the transfer case bolts to the specified torque a little at a time.

Transfer Case Bolt Torque	kg·m (lb·ft/N·m)
$3.8 \pm 0.8$ (27.5 $\pm$ 5.8/39.2	± 7.8)

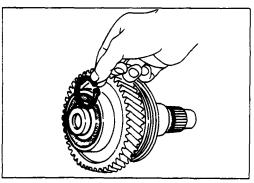




#### 2. Counter Gear

## 3. Sub Gear (Anti-lash Plate)

Apply chassis grease to the sub-gear and the counter gear thrust surfaces.

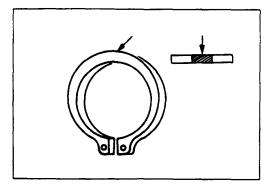




#### 7. Snap Ring

- 1) Select a snap ring that will allow the minimum axial play.
- 2) Use a pair of snap ring pliers to install the snap ring to the counter gear.

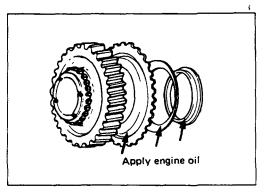
mm(in)



Snap Ring Availability

mm(in)

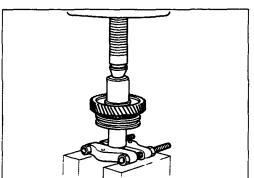
The princip retained into	***************************************
Thickness	Color-Coding
1.50 (0.059)	White
1.55 (0.061)	Yellow
1.60 (0.063)	Blue





- 16. Front Output Gear
- 17. Sub Gear (Anti-lash Plate)
- 18. Belleville Spring
- 19. Spacer

Apply engine oil to the thrust surfaces of the sub-gear, the belleville spring, and the spacer.

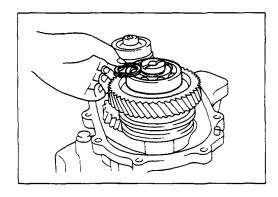




## 20. Anti-lash Plate Snap Ring

## 21. Bearing Collar

Use a bench press to install the needle bearing and collar together with the front output gear.

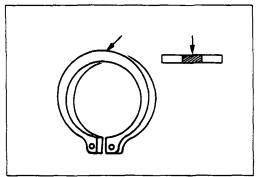




## 23. Snap Ring

- 1) Select a snap ring that will allow the minimum axial play.
- 2) Use a pair of snap ring pliers to install the snap ring to the output shaft.

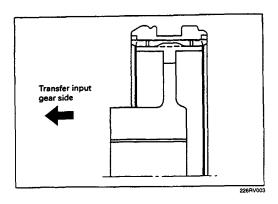
Bearing and Snap Ring Clearance	mm(in)
Standard	
0 - 0.1 (0 - 0.0039)	





nap		
	<u> </u>	

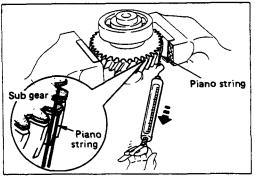
Snap Ring Availability	mm(in)		
Snap Ring Thickness	Color Coding		
1.55 (0.061)	White		
1.60 (0.063)	Yellow		
1.65 (0.065)	) Blue		
1.70 (0.067)	Pink		
1.75 (0.069)	Green		
1.80 (0.071)	Brown		
1.85 (0.073)	Red		
1.90 (0.075)	Orange		





## 30. High-Low Clutch Hub and Sleeve

The clutch hub face with the heavy bass must be facing the transfer input gear side.

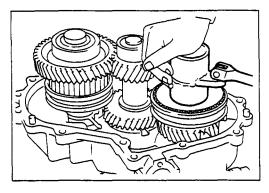




#### Sub Gear (Anti-lash Plate) Preload

- 1) Hook a length of piano wire over one of the sub-gear teeth.
- 2) Attach the other end of the piano wire to a spring balancer.
- 3) Measure the sub-gear preload.

Sub-Gear Preload	kg(lb/N)
Standard	
5 - 12 (11.0 - 26.5/49.0 - 117.6)	





### 32. Mainshaft End Lock Nut

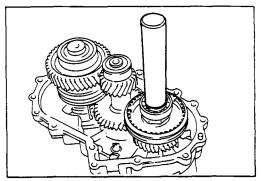
1) Use the lock nut wrench to tighten the mainshaft end lock nut to the specified torque.

Lock Nut Wrench: J-37219

 Mainshaft End Lock Nut Torque
 kg⋅m (Ib⋅ft/N⋅m)

 13 ± 1 (94.0 ± 7.2/127.4 ± 9.8)

2) Stake the lock nut.



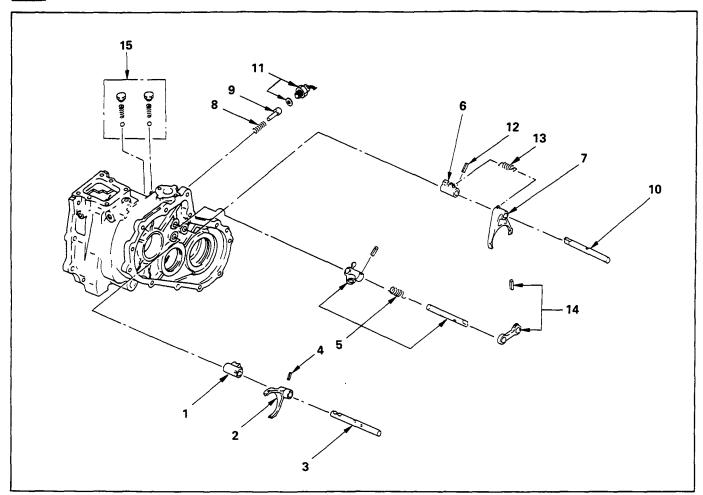


## 33. Ball Bearing

Use the ball bearing installer to install the ball bearing. Installer: 5-8840-2159-0 (J-37223)

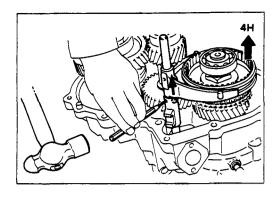


## DETENT, SHIFT ARM ASSEMBLY AND INTERLOCK PIN



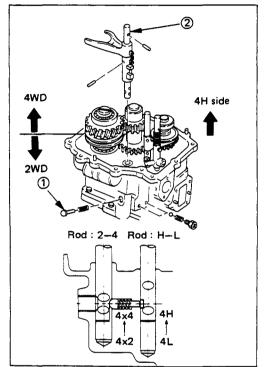
- 1. Shift block
- 2. Shift arm
- ▲ 3. High-low shift rod
- ▲ 4. Spring pin
  - 5. Select rod assembly
  - 6. Shift block
  - 7. Shift arm
  - 8. Spring

- 9. Interlock pin
- ▲ 10. 2WD-4WD shift rod
- ▲ 11. 4WD indicator switch
- ▲ 12. Spring pin
  - 13. Spring
  - 14. Pin and bridge
- ▲ 15. Detent ball, spring and plug





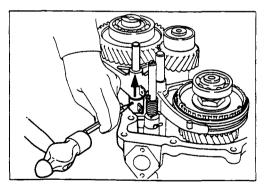
- 3. High-Low Shift Rod
- 4. Spring Pin
- 1) Engage the High-Low sleeve with 4H side.
- 2) Install the spring pin to the shift block.





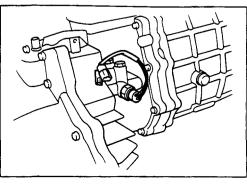
#### 9. Interlock Pin

- 10. 2WD-4WD Shift Rod
  - 1) Engage the High-Low synchronizers with 4H side and install the interlock pin 1 in proper direction.
  - Install the shift rod: 2WD-4WD 2 with the interlock pin pushed it in.



#### 12. Spring Pin

 Engage the 2WD-4WD sleeve with the 4WD side and install the spring pin.





## 11. 4WD Indicator Switch

Tighten the switch to the specified torque.

Switch Torque

kg·m(lb.ft/N·m)

4 (29.0/39.2)



## 15. Detent Ball, Spring and Plug

Tighten the plugs to the specified torque.

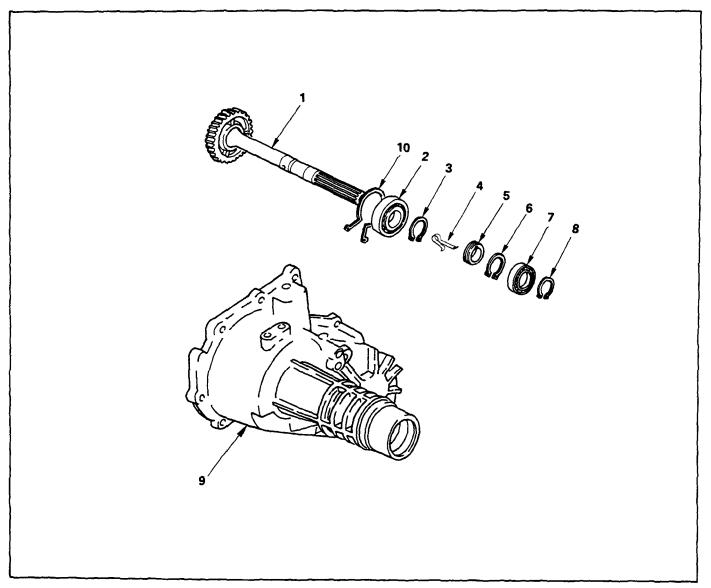
Plug Torque

kg·m(lb.ft/N·m)

 $1.9 \pm 0.4 (13.7 \pm 2.9/18.6 \pm 3.9)$ 



## TRANSFER REAR CASE ASSEMBLY



- 1. Rear output shaft
- ▲ 2. Ball bearing
  - 3. Bearing snap ring
- ▲ 4. Clip
  - 5. Speedometer drive gear
  - 6. Bearing snap ring

- ▲ 7. Ball bearing
  - 8. Bearing snap ring
  - 9. Rear case
  - 10. Bearing snap ring

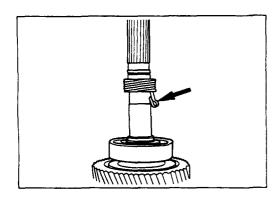


## 2. Ball Bearing

Use the ball bearing installer and the adapter to install the ball bearing.

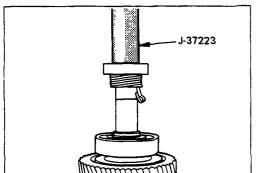
Ball Bearing Installer: 5-8840-2159-0 (J-37223)

Adapter: 5-8840-2192-1 (J-37486-A)



## 4. Clip

Install the clip to the drive gear groove.



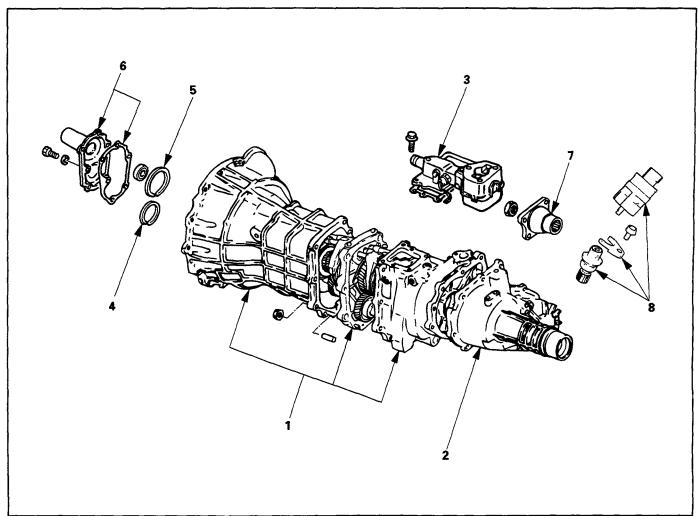


## 7. Ball Bearing

Use the ball bearing installer to install the ball bearing.

Ball Bearing Installer: 5-8840-2159-0 (J-37223)

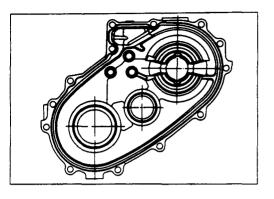
## **EXTERNAL COMPONENTS**



#### 2201 V003

- 1. Transmission and transfer assembly
- ▲ 2. Transfer rear case assembly
  - 3. Gear control box assembly
- ▲ 4. Counter gear snap ring

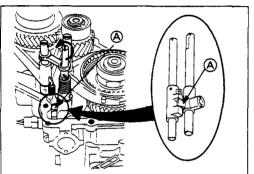
- ▲ 5. Bearing snap ring
- ▲ 6. Front cover with oil seal
- ★ 7. Transfer flange
- 8. Speedometer driven gear and speedometer sensor





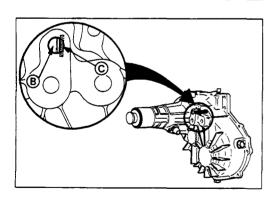


- 2. Transfer Rear Case Assembly
- 1) Apply recommended liquid gasket or its equivalent to the transfer rear case fitting faces.





- 2) Apply the following steps before fitting the transfer rear case.
  - Shift the High-Low synchronizer to the 4H side.
  - ② Turn the select rod counterclockwise so that the select block projection (A) may enter into the 2WD-4WD shift block.



When the rear case is fitted under this condition ②, the direction of the cut-away portion of select rod head ® aligns with that of the rear case hole's stopper ©.

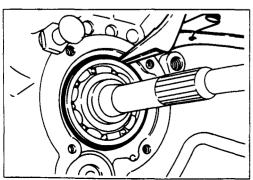
3) Tighten the rear transfer rear case bolts to the specified torque.



Transfer Case Bolt Torque

kg·m (lb·ft/N·m)

 $3.8 \pm 0.8$  (27.5 ± 5.8/37.2 ± 7.8)



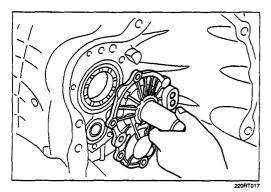


## 4. Counter Gear Snap Ring

## 5. Bearing Snap Ring

Use a pair of snap ring pliers to install the snap ring to the mainshaft.

The snap ring must be fully inserted into the ball bearing snap ring groove.





#### 6. Front Cover with Oil Seal

- 1) Apply recommended liquid gasket or its equivalent to the through bolt threads.
- 2) Install the new gasket and the front cover with oil seal to the transmission case.

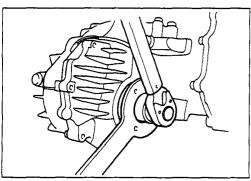
Take care not to damage the oil seal.

3) Tighten the front cover bolts to the specified torque.

Front Cover Bolt Torque

kg·m (lb·ft/N·m)

 $1.9 \pm 0.4 (13.7 \pm 2.9/18.6 \pm 3.9)$ 





### 7. Transfer Flange

 Use the flange holder to install the flange to the rear transfer case.

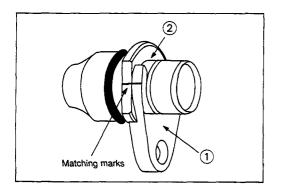
Flange Holder: 5-8840-2157-0 (J-27221)

2) Tighten the transfer flange bolts to the specified torque.

Transfer Flange Bolt Torque

kg·m(lb.ft/N·m)

 $13 \pm 1 (94.0 \pm 7.2/127.4 \pm 9.8)$ 







## 8. Speedometer Driven Gear and Speedometer Sensor

1) Align the matching marks on plate ① and bush ② then tighten the bolt.

**Bolt Torque** 

kg·m (lb·ft/N·m)

1.5 (10.8/14.7)

2) Install the speedmeter sensor.

kg·m (lb·ft/N·m)

2.8 (20/27)

## **TROUBLESHOOTING**

Refer to this Section to quickly diagnose and repair engine problems. Each troubleshooting chart has three headings arranged from left to right.

(1) Checkpoint (2) Trouble Cause (3) Countermeasure

This Section is divided into four sub-sections:

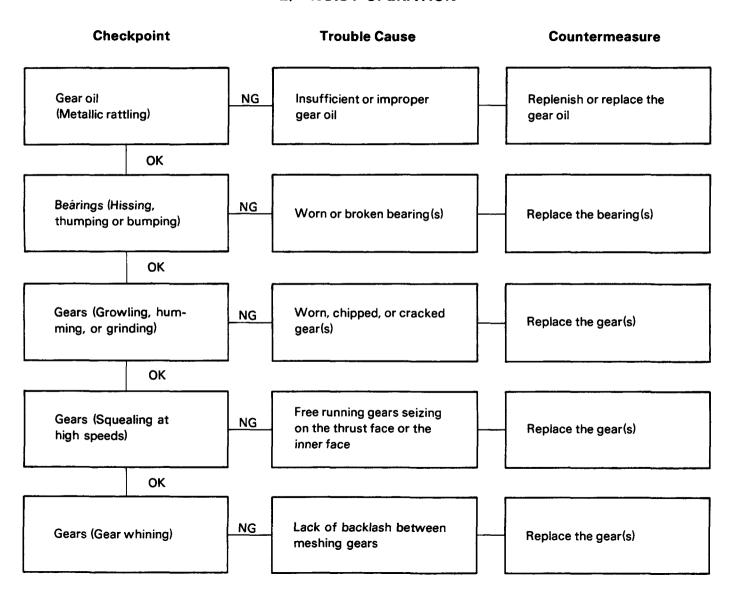
- 1. Abnormal Noise
  - 1) Noise in Neutral
  - 2) Noisy Operation
- 2. Head Shifting
- 3. Walking or Jumping Out of Gear
- 4. Oil Leakage

# 1. ABNORMAL NOISE

# 1) NOISY IN NEUTRAL

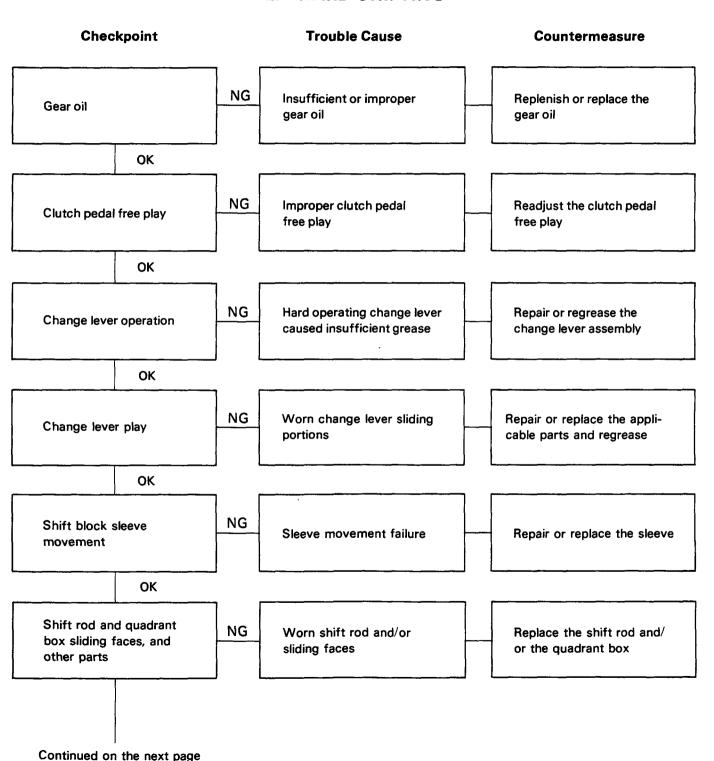
Checkpoint			Trouble Cause		Countermeasure
Gear oil		NG	Insufficient or improper gear oil		Replenish or replace the gear oil
0	K	i		J L_	
Flywheel pilot bea	aring	NG	Worn flywheel pilot bearing		Replace the flywheel pilot
0	K	,		J	
Bearings (Mainsha shaft, and transfer		NG	Worn or broken bearing(s)		Replace the bearing(s)
0	K	•		_	
Gears (Mainshaft, shaft, reverse idler and transfer gears	rgear -	NG	Worn or scuffed gear tooth contact surfaces		Replace the gear(s)
0	К				
Mainshaft splines Synchronizer clu- hub splines		NG	Worn splines		Replace the main shaft and the synchronizer clutch hub
0	OK .				
Transmission		NG	Transmission misalignment		Realign the transmission

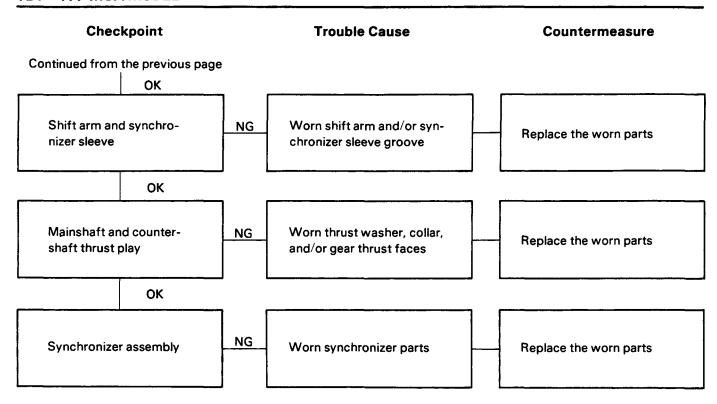
## 2) NOISY OPERATION



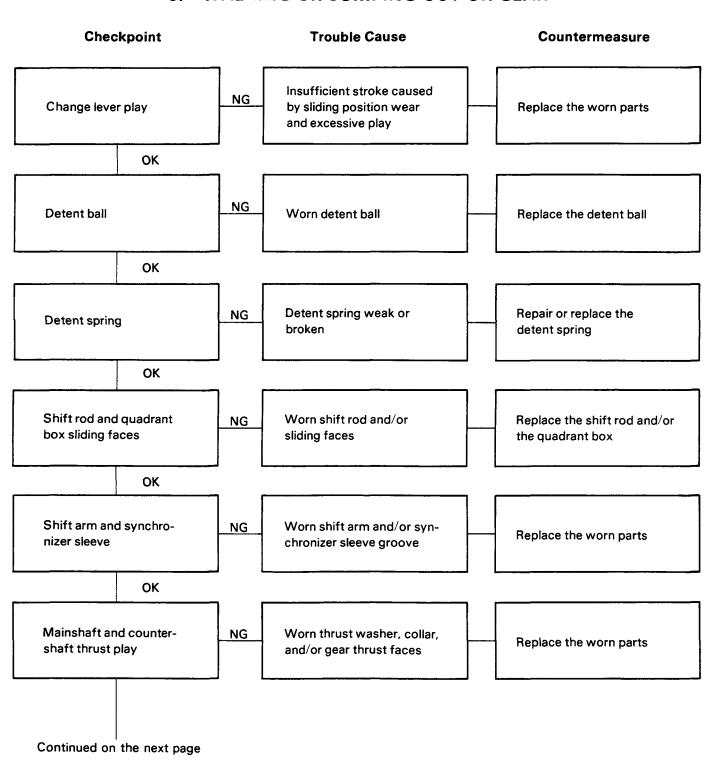
## 2. HARD SHIFTING

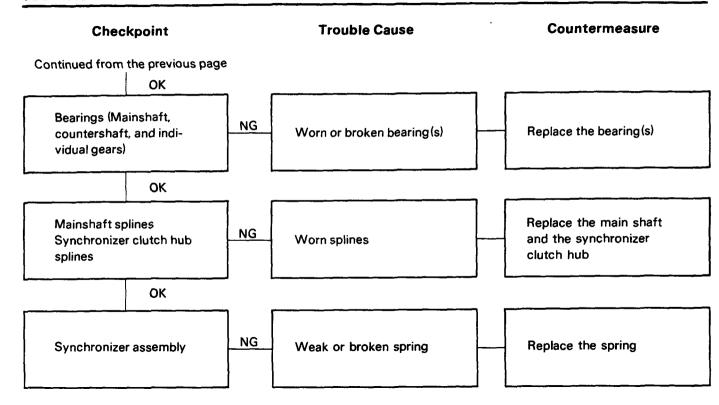
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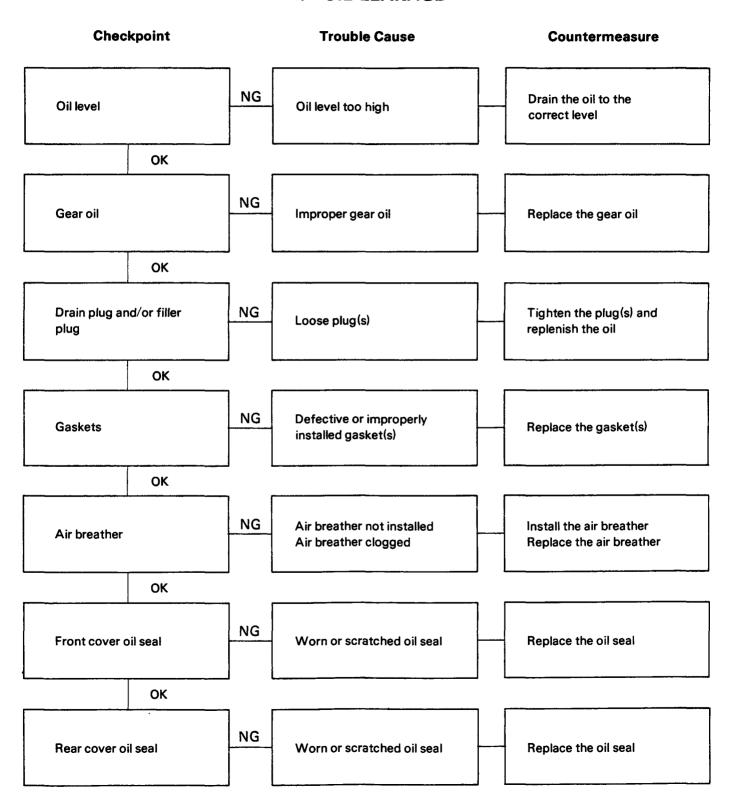


## 3. WALKING OR JUMPING OUT OR GEAR





## 4. OIL LEAKAGE













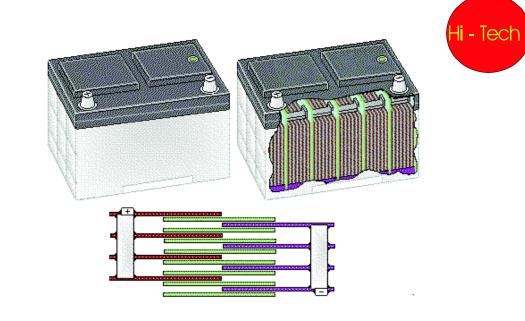
Symbols

Parts

Main data

Specs.

Repairs



### KB TF 140 Electrical

## SECTION 8 ELECTRICAL-BODY AND CHASSIS

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#### **GENERAL INFORMATION**

The body and chassis electrical system operates on a twelve volt power supply with negative ground polarity.

The main harness consists of the engine harness, the instrument harness, the body harness, and the chassis harness.

The harnesses use a split corrugated tube to protect the wires from the elements.

Wire size is determined by current flow, circuit length, and voltage drop.

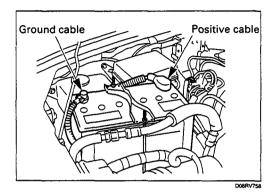
All wires have color-coded insulation.

Wire color-codes are shown in the circuit diagrams. This makes it easier to trace circuits and to make the proper connections.

Each circuit consists of the following:

- 1. Power source The battery and the alternator
- 2. Wires To carry electrical current through the circuit
- 3. Fuses To protect the circuit against current overload
- 4. Relays To protect voltage drop between the battery and the circuit parts and to protect the switch points against burning
- 5. Switches To open and close the circuit
- 6. Load Any device, such as a light or a motor, which converts the electrical current into useful work
- 7. Ground To allow the current to flow back to the power source

#### NOTES FOR WORKING ON ELECTRICAL ITEMS



#### **BATTERY CABLE**

#### **Disconnecting the Battery Cable**

- 1. All switches should be "OFF" position.
- 2. Disconnect the battery ground cable.
- 3. Disconnect the battery positive cable.

#### CALITION

It is important that the battery ground cable be disconnected first.

Disconnecting the battery positive cable first can result in a short circuit.



#### **Connecting the Battery Cable**

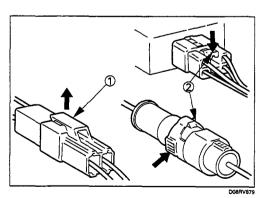
CONNECTOR HANDLING
Disconnecting the Connectors

together during vehicle operation.

Follow the disconnecting procedure in the reverse order to connect the battery cables.

#### CAUTION:

Clean the battery terminal and apply light coat of grease to prevent terminal corrosion.



Other tang locks are released by pressing them forward (2).

Some tang locks are released by pulling them towards

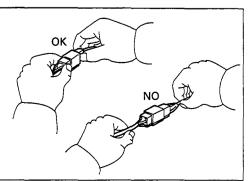
Some connectors have a tang lock to hold the connectors

Determine which type of tang lock is on the connector being handled.

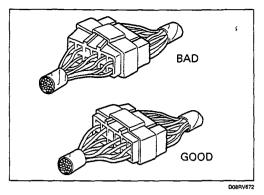
Firmly grasp both sides (male and female) of the connector.

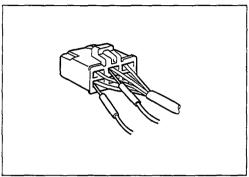
Release the tang lock and carefully pull the two halves of the connector apart.

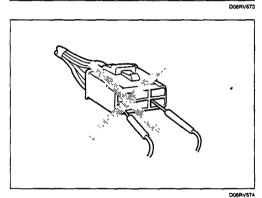
Never pull on the wires to separate the connectors. This will result in wire breakage.

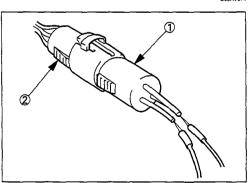


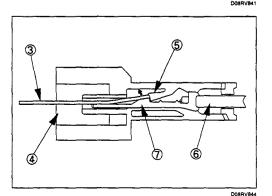
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#### **Connecting the Connectors**

Firmly grasp both sides (male and female) of the connector.

Be sure that the connector pins and pin holes match.

Be sure that both sides of the connector are aligned with each other.

Firmly but carefully push the two sides of the connector together until a distinct click is heard.

#### **Connector Inspection**

Use a circuit tester to check the connector for continuity. Insert the test probes from the connector wire side.

#### **CAUTION**

Never insert the circuit tester test probes into the connector open side to test the continuity.

Broken or open connector terminals will result.

#### **Waterproof Connector Inspection**

It is not possible to insert the test probes into the connector wire side of a waterproof connector.

Use one side of a connector ① with its wires cut to make the test.

Connect the test connector to the connector  $\ensuremath{\mathfrak{D}}$  to be tested.

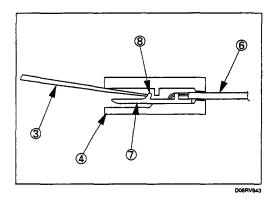
Connect the test probes to the cut wires to check the connector continuity.

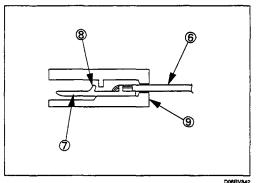
#### **Connector Pin Removal**

#### **Connector Housing Tang Lock Type**

- 1. Insert a slender shaft ③ into the connector housing open end ④.
- 2. Push the tang lock ⑤ up (in the direction of the arrow in the illustration).

Pull the wire (a) with pin (7) free from the wire side of the connector.





#### Pin Tang Lock Type

- 1. Insert a slender shaft ③ into the connector housing open end ④.
- 2. Push the tang lock ® flat (toward the wire side of the connector).

Pull the wire **(6)** with pin **(7)** free from the wire side of the connector.

#### **Connector Pin Insertion**

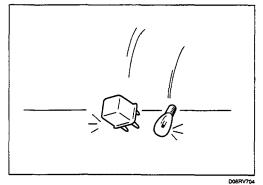
- 1. Check that the tang lock ® is fully up.
- 2. Insert the pin ⑦ from the connector wire side ⑨. Push the pin in until the tang lock closes firmly.
- 3. Gently pull on the wires **(6)** to make sure that connector pin is firmly set in place.

#### **Fuse Replacement**

The replacement fuse must have the same amperage specification as the original fuse.

Never replace a burn out fuse with a fuse of a different amperage specification. Doing so can result in an electrical fire or other serious circuit damage.

Be careful for parts handling and any part should not be dropped or thrown, otherwise short circuit or disorder

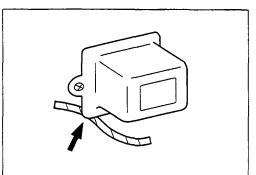


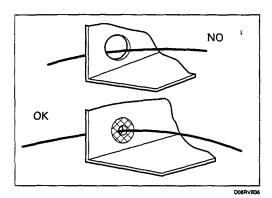
#### may result.

**Parts Handling** 

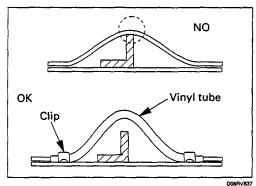
#### Wiring Harness

- 1. When assembling the parts, be careful not to bite or wedge the wiring harness.
- 2. All electrical connections must be kept clean and tight.

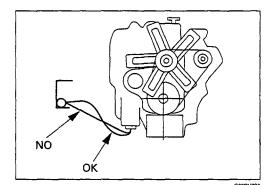




3. Use a grommet or guard tube to protect the wiring harness from contacting a sharp edge or surface.



4. Position the wiring harness with enough clearance from the other parts and guard the wiring harness with a vinyl tube to avoid direct contact.



5. The wiring harness between engine and chassis should be long enough to prevent chafing or damage due to various vibrations.

#### SPLICING WIRE

#### **Open the Harness**

If the harness is taped, remove the tape. To avoid wire insulation damage, use a sewing "seam ripper" (available from sewing supply stores) to cut open the harness.

If the harness has a black plastic conduit, simply pull out the desired wire.

#### Cut the wire

Begin by cutting as little wire off the harness as possible. You may need the extra length of wire later if you decide to cut more wire off to change the location of a splice. You may have to adjust splice locations to make certain that each splice is at least 1-1/2" (40 mm) away from other splices, harness branches, or connectors.

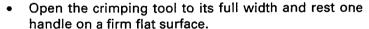
#### Strip the insulation

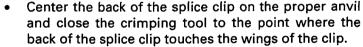
When replacing a wire, use a wire of the same size as the original wire. Check the stripped wire for nicks or cut stands. If the wire is damaged, repeat the procedure on a new section of wire. The two stripped wire ends should be equal in length.



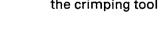
Select the proper clip to secure the splice. To determine the proper clip size for the wire being spliced, follow the directions included with your clips. Select the correct anvil on the crimper. (On most crimpers your choice is limited to either a small or large anvil.) Overlap the two stripped wire ends and hold them between your thumb and forefinger.

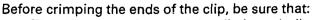
Then, enter the splice clip under the stripped wires and hold it in place.





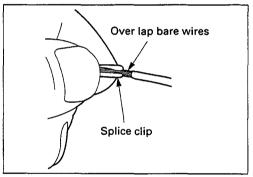
 Make sure that the clip and wires are still in the correct position. Then, apply steady pressure until the crimping tool closes.



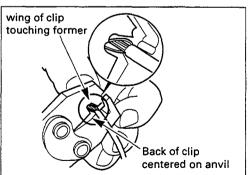


- The wires extend beyond the clip in each direction.
- · No strands of wire are cut loose, and
- No insulation is caught under the clip.

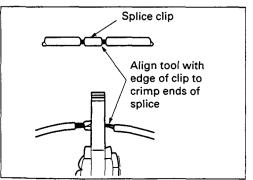
Crimp the splice again, once on each end. Do not let the crimping tool extend beyond the edge of the clip or you may damage or nick the wires.

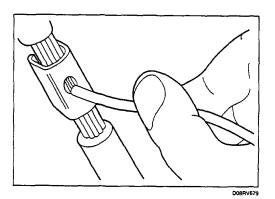


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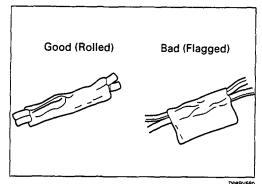
D08RV678





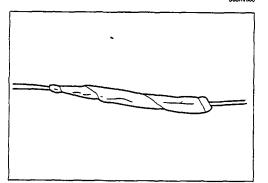
#### Solder

Apply 60/40 rosin core solder to the opening in the back of the clip. Follow the manufacturer's instructions for the solder equipment you are using.



#### Tape the Splice

Center and roll the splicing tape. The tape should cover the entire splice. Roll on enough tape to duplicate the thickness of the insulation on the existing wires. Do not flag the tape. Flagged tape may not provide enough insulation, and the flagged ends will tangle with the other wires in the harness.



If the wire does not belong in a conduit or other harness covering, tape the wire again. Use a winding motion to cover the first piece of tape.

#### **SYMBOLS AND ABBREVIATIONS**

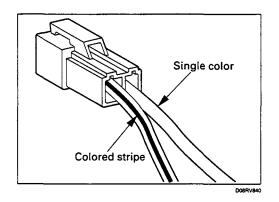
#### **SYMBOLS**

Symbol	Meaning of Symbol	Symbol	Meaning of Symbol
-00-	Fuse	0	Bulb
	Fusible link	6	Double filament bulb
-0/0-	Fusible link wire	[ <b>M</b> ]	Motor
	Switch		Variable resistor Rheostat
	Switch		Coil (inductor), solenoid, magnetic valve
	Switch (Normal close type)		
	Contact wiring	7000	Relay
0 0 + -	Battery		
	Diode		Connector
	Electronic Parts		Light emitting diode
<b>-</b>	Resistor		Reed switch
1	Speaker		Condenser
	Buzzer	-5-	Horn
	Circuit breaker	=>=====================================	Vacuum switching valve

#### **ABBREVIATIONS**

Abbreviation	Meaning of Abbreviation	Abbreviation	Meaning of Abbreviation
Α	Ampere (S)	LH	Left hand
ABS	Anti-lock brake system	LWB	Long wheel base
ASM	Assembly	MPI	Multiport fuel injection
AC	Alternating current	M/T	Manual transmission
A/C	Air conditioner	OD	Over drive
ACC	Accessories	ОРТ	Option
A/T	Automatic transmission	gos	Quick on start
CARB	Carburetor	RH	Right hand
C/B	Circuit breaker	RR	Rear
CSD	Cold start device	RWAL	Rear wheel anti-lock brake system
DIS	Direct ignition system	SRS	Supplemental restraint system
EBCM	Electronic brake control module	ST	Start
ECGI	Electronic control gasoline injection	STD	Standard
ECM	Engine control module	sw	Switch
ECU	Electronic control unit	SWB	Short wheel base
EFE	Early fuel evaporation	ТСМ	Transmission control module
4A/T	4-speed automatic transmission	3A/T	3-speed automatic transmission
4×4	Four-wheel drive	V	Volt
FL	Fusible link	VSV	Vacuum switching valve
FRT	Front	w	Watt (S)
H/L	Headlight	WOT	Wide open throttle
IC	Integrated circuit	W/	With
IG	Ignition	W/O	Without
kW	kilowatt		

#### PARTS FOR ELECTRICAL CIRCUIT

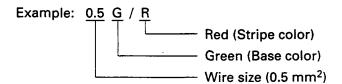


#### WIRING

#### **Wire Color**

All wires have color-coded insulation.

Wires belonging to system's main harness will have a single color. Wires belonging to a system's sub-circuits will have a colored stripe. Striped wires use the following code to show wire size and colors.



Abbreviations are used to indicate wire color within a circuit diagram.

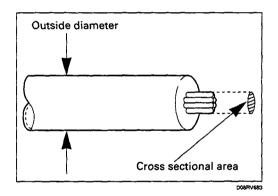
Refer to the following table.

#### **Wire Color-Coding**

Color-Coding	Meaning	Color-Coding	Meaning	
В	Black	BR	Brown	
W	White	LG	Light green	
R	Red	GR	Grey	
G	Green	Р	Pink	
Y	Yellow	LB	Light blue	
L	Blue	V	Violet	
0	Orange			

#### **Distinction of Circuit by Wire Base Color**

Base color	Circuits	Base color	Circuits
В	Starter circuit and grounding circuit	Υ	Instrument circuit
W	Charging circuit	I O PP	
R	Lighting circuit	L,O, BR, LG, GR,	Other circuits
G	Signal circuit	P, LB, V	

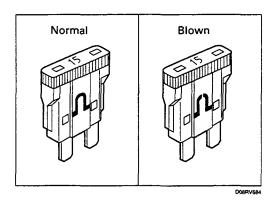


#### Wire Size

Wire size is specified with the metric gauge system. The metric gauge system gives the wire size in cross sectional area measured in square millimeters.

#### Wire Size Specifications

Normal size	Cross sectional area (mm²)	Outside diameter (mm)	Allowable current (A)
0.3	0.372	1.8	9
0.5	0.563	2.0	12
0.85	0.885	2.2	16
1.25	1.287	2.5	21
2	2.091	2.9	28
3	3.296	3.6	37.5
5	5.227	4.4	53
8	7.952	5.5	67
15	13.36	7.0	75
20	20.61	8.2	97



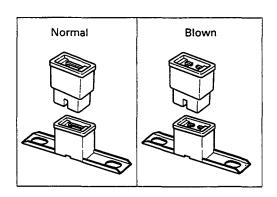
#### **FUSE**

Fuses are the most common form of circuit protection used in vehicle wiring. A fuse is a thin piece of wire or strip of metal encased in a glass or plastic housing. It is wired in series with the circuit it protects. When there is an overload of current in a circuit, such as a short of a ground, the wire or metal strip is designed to burn out and interrupt the flow of current. This prevents a surge of high current from reaching and damaging other components in the circuit.

Determine the cause of the overloaded before replacing the fuse.

Never replace a blown fuse with a fuse of a different amperage specification.

Doing so can result in an electrical fire or other serious circuit damage. A blown fuse is easily identified.



#### **FUSIBLE LINK**

The fusible link is primarily used to protect circuits where high amounts of current flow and where is would not be practical to use a fuse. For example, the starter circuit. When a current overload occurs, the fusible link melts open and interrupts the flow of current so as to prevent the rest of the wiring harness from burning.

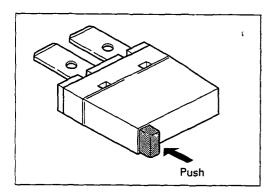
Determine the cause of the overload before replacing the fusible link. The replacement fusible link must have the same amperage specification as the original fusible link.

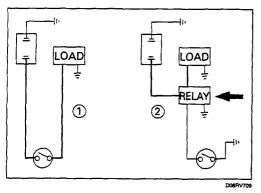
Never replace a blown fusible link with fusible link of a different amperage specification. Doing so can result in an electrical fire or other serious circuit damage.

A blown fusible link is easily identified.

#### **Fusible Link Specifications**

Туре	Type Rating		Maximum Circuit Current (A)		
Connector	30A	Pink	15		
Connector	40A	Green	20		
Bolted	50A	Red	25		
Bolted	60A	Yellow	30		
Bolted	80A	Black	40		





#### CIRCUIT BREAKER

The circuit breaker is a protective device designed to open the circuit when a current load is in excess of rated breaker capacity. If there is a short or other type of overload condition in the circuit, the excessive current will open the circuit between the circuit breaker terminals. The reset knob pops out when the circuit is open. Push the reset knob in place to restore the circuit after repairing it.

#### RELAY

Battery and load location may require that a switch be placed some distance from either component. This means a longer wire and a higher voltage drop ①. The installation of a relay between the battery and the load reduces the voltage drop ②.

Because the switch controls the relay, amperage through the switch can be reduced.

#### **Relay Specifications and Configurations**

Name/ Color	Rated voltage/ Coil resistance	Internal circuit
1T (MR5C)/ Black	12V Approx. 90Ω Minimum operating voltage: 7V at 25°C(77°F)	
1T (MR5C)/ Brown	12V Approx. 90Ω Minimum operating voltage: 10.5V at 25°C(77°F)	OSORVOOS

<sup>\*</sup> Relay contact shown in the wiring diagram indicates condition before actuation.

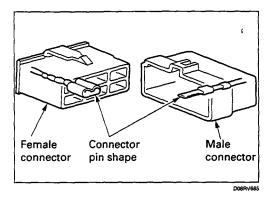
#### DIODE

#### **Diode Specifications and Configurations**

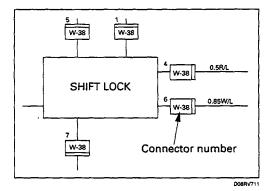
SHAPE	MARK/ COLOR	CONSTRUCTION	CHECKING EITHER A	HOULD BE CONTINUITY IN A OR B WHEN A CIRCUIT IS CONNECTED WITH ERMINAL	
	BLACK	2	TERMINAL NO.  CONNECTION A PATTERN B	<del></del>	
	0 \ 0 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		TERMINAL NO.	3 2 1 ⊕ ⊕	
	BLACK		PATTERN B		
	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3	3	TERMINAL NO.	3 2 1
		2	CONNECTION A	$\begin{array}{c c} & \oplus & \ominus \\ \hline & \ominus & \end{array}$	
District Control	BLACK		В	$\ominus$ $\oplus$	
	<b>0</b>		TERMINAL NO.	4 3 2 1	
	4-40	4		⊕ ⊝	
	<b>1</b>	3	3	3   CONN	CONNECTION
	1 PATTERN	PATTERN B			
	BLACK			⊕ ⊖ ⊝	

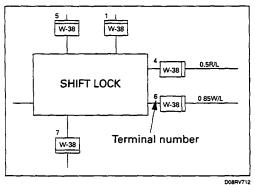
#### Maximum Rating (Temp.=25°C)

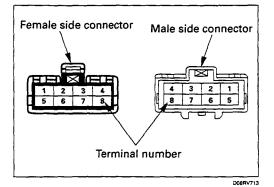
Items	Rating	Remarks
Peak reverse voltage	400V	
Transient peak reverse voltage	500V	
Average output current	1.5A	Temp.=40°C
Working ambient temperature	-30°C~80°C	
Storage temperature	-40°C~100°C	



# Female side connector Male side connector







#### **CONNECTOR**

The connector pin shape determines whether the connector is male or female.

The connector housing configuration does not determine whether a connector is male or female.

The symbol illustrated in the figure is used as connector in the circuit of this section.

Connector is identified with a number.

The applicable terminal number is shown for each connector.

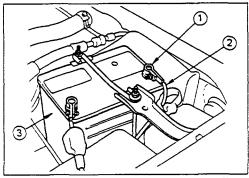
Connector terminal numbers are clearly shown.

Male side connector terminal numbers are in sequence from upper right to lower left.

Female side connector terminal numbers are in sequence from upper left to lower right.

#### NOTE:

For those connectors on which specific terminal numbers on symbols are shown, the terminal numbers or symbols are used in the circuit diagram, irrespective of the above rule.



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#### **BATTERY**

#### Inspection

- 1. Check the battery terminals ① for corrosion.
- 2. Check the battery cables ② for looseness.
- 3. Check the battery case 3 for cracks and other damage.
- Check the battery electrolyte level.
   If the electrolyte level is excessively low, the battery must be replaced.
- 5. If the battery has a built-in hydrometer, perform the following steps:
  - 1) Carefully clean the battery upper surface.
  - 2) Check the hydrometer.

The hydrometer design will vary with the battery manufacturer.

Refer to the illustration shown on the battery.

#### **Battery Replacement**

- 1. Disconnect the battery ground cable ①.
- 2. Disconnect the battery positive cable 2.
- 3. Remove the battery clamp ③.
- 4. Remove the battery

#### Caution:

It is important that the battery ground cable be removed first.

Removing the battery positive cable first can result in a short circuit.

#### Jump Starting the Engine with a Booster Battery

The following description assumes that you are using a booster battery mounted on a second vehicle.

The listed steps (with some minor modifications) are also applicable if you are using a naked booster battery or special battery charging equipment.

#### Caution:

Never push or tow the vehicle in an attempt to start it. Extensive damage to the emission system and other vehicle parts will result. (only catalytic converter vehicle) Treat both the discharged battery and the booster battery with great care when using jumper cables.

Carefully follow the procedure outlined below.

Always be aware of the dangers of sparking.

Failure to follow the following procedure can result in:

- a. Serious personal injury, especially to your eyes.
- b. Extensive property damage from a battery explosion, battery acid discharge, or electrical fire.
- c. Extensive damage to the electronic components of both vehicles.

Do not use a 24 volt booster battery. Serious damage to the vehicle's electrical system and electronic components will result.

#### **Jump Starting Procedure**

- 1. Set the parking brake on both vehicles.
- If one or both vehicles is equipped with an automatic transmission, place the selector lever in the "PARK" position.

If one or both vehicles is equipped with a manual transmission, place the gear shift in the "NEUTRAL" position.

- Turn off the ignition on both vehicles.
- 4. Turn off all vehicle lights and accessories.
- 5. Check the built-in hydrometer on the discharged battery (If so equipped).

If there is no hydrometer indication abandon the jump start procedure.

- 6. Be sure that the two vehicles are not touching.
  - Attach the end of one jumper cable to the booster battery positive terminal.
- Attach the other end of the same cable to the discharged battery positive terminal.
- Once again, check that the booster battery has a 12volt rating.
- 9. Attach one end of the remaining booster cable to the booster battery negative terminal.
- 10. Attach the other end of the booster cable to a solid ground (such as the air conditioner compressor mounting bracket or the alternator mounting bracket) in the engine room of the vehicle with the discharged battery.

Be sure that the ground connection is at least 500 mm (20 in) from the discharged battery.

#### Caution:

Do not attach the booster cable to the discharged battery negative terminal.

 Start the engine of the vehicle with the booster battery.
 Check that all unnecessary electrical accessories are

off.

12. Start the engine of the vehicle with the discharged

13. Remove the jumper cables in the reverse order to which they were attached.

#### Caution:

battery.

Be absolutely sure to remove the negative jumper cable from the vehicle with the discharged battery first.

#### READING THE CIRCUIT DIAGRAM

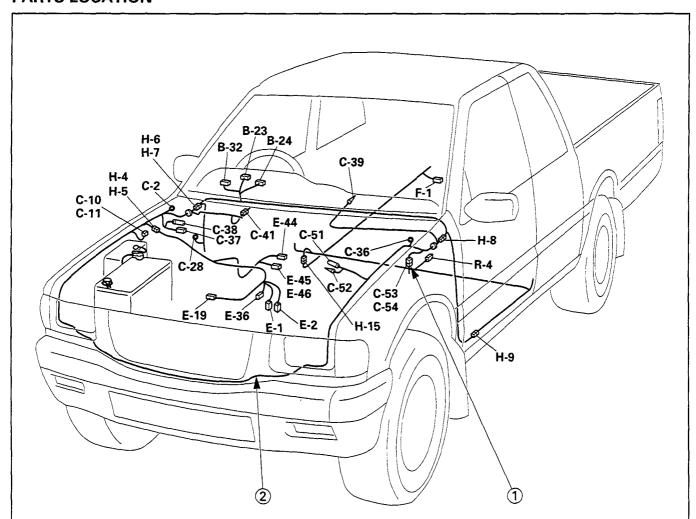
In this manual, each system has its own parts location illustration and circuit diagram. And connector configurations used in the circuit diagram are shown at the end of this manual.

**PARTS LOCATION:** The parts location shows the location of the connectors ① and the harnesses ② used in the each system.

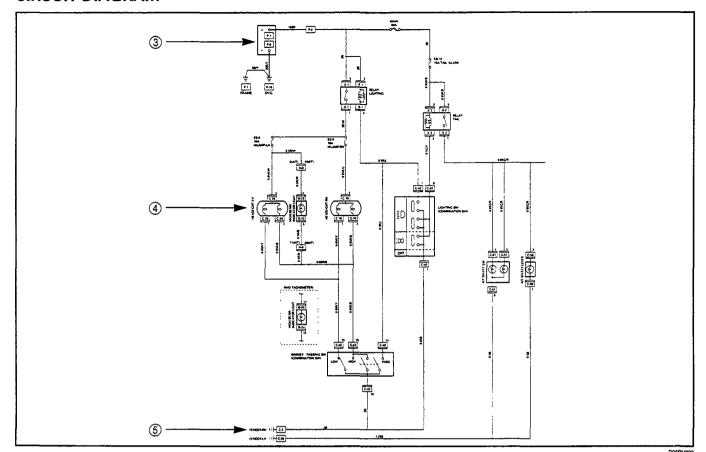
**CIRCUIT DIAGRAM**: The circuit diagram shows the power supply ③, the load or loads ④ and the grounding point(s) ⑤.

**CONNECTOR LIST**: The connector configuration shows each connector's number ⑥, configuration ⑦ and the pin numbers ⑧.

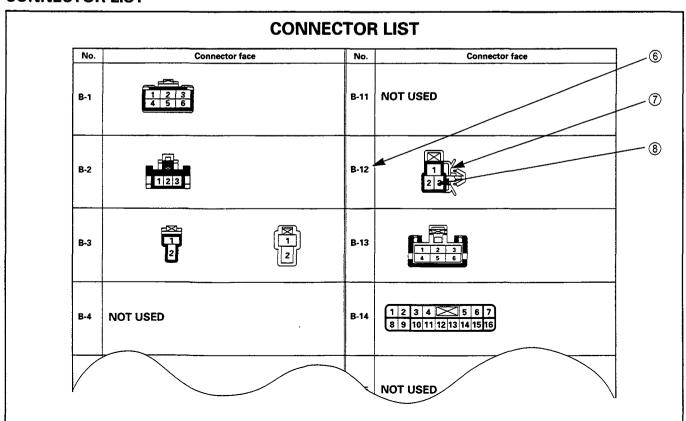
#### PARTS LOCATION



#### **CIRCUIT DIAGRAM**



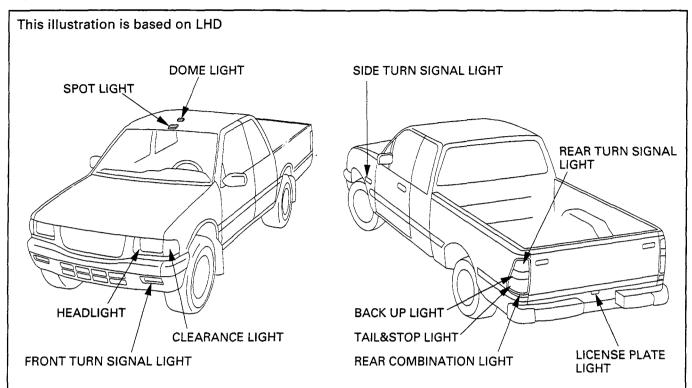
#### **CONNECTOR LIST**



D08RV911

#### MAIN DATA AND SPECIFICATIONS

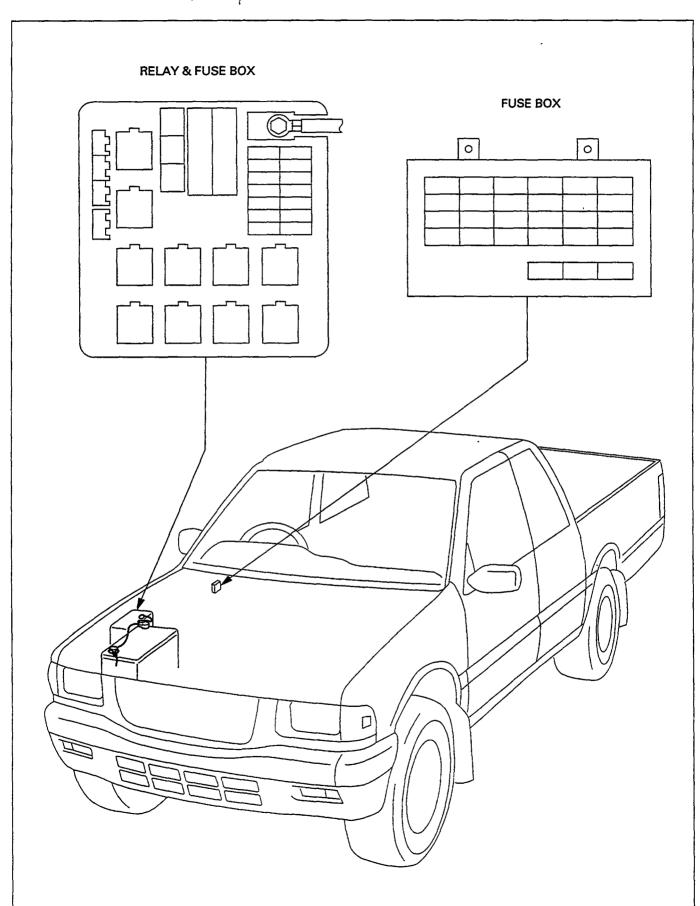
#### **BULB SPECIFICATIONS**



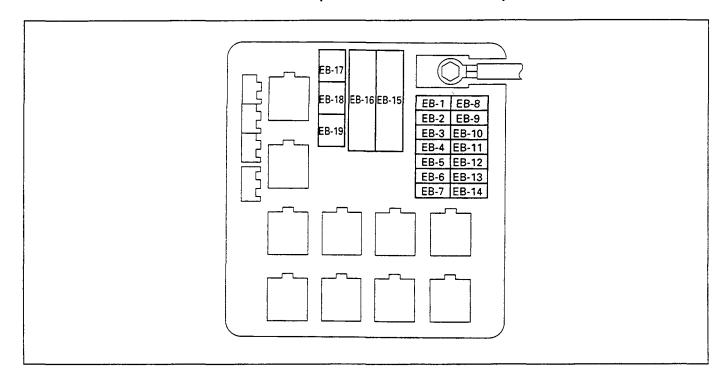
Rated Power Number Lens Bulb No. Remarks Light Name V-W of Bulbs Color H4 2 White 12-60/55 Halogen Headlight R2 12-45/40 2 White 2 Front turn signal light 12-23 Amber W5W 12-5 2 Amber Side turn signal light **P21W** 12-21 Rear turn signal light 2 Amber P21/5W 12-21/5 2 Red Tail and stop light P21W 2 White Back up light 12-21 License plate light W5W 12-5 1 or 2 White Clearance light W5W 12-5 2 White 12-0.7 A/C-Heater control light 1 12-10 1 White Dome light 12-5 2 White Spot light 12-5 1 White Inspection light

	Light name		Buib No.	Rated power V-W	Number of of bulbs	Lens colour	Remarks
	Charging system	Gasoline engine	-	14-3.0	1	RED	
		Diesel engine	74	14-1.4	1		
	Check engine		74	14-1.4	1	Red	Gasoline (MPI) engine
	Turn signal	W/O Tachometer	158	14-3.4	2	Green	
		W/Tachometer	74	14-1.4	2		
분	High beam	W/O Tachometer	158	14-3.4	1	Blue	
INDICATOR / WARNING LIGHT		W/Tachometer	74	14-1.4	1		
RNIN	Low fuel	W/O Tachometer	-	14-3.0	1	Amber	
/ WA		W/Tachometer	74	14-1.4	1		
TOR	Oil pressure		74	14-1.4	1	Red	
DIC	Brake system		74	14-1.4	1	Red	
=	4WD	W/O Tachometer	158	14-3.4	1	Green	
		W/Tachometer	74	14-1.4	1		
	Overdrive off		74	14-1.4	1	Amber	A/T
	Glow		74	14-1.4	1	Amber	Diesel engine
	Sedimenter		74	14-1.4	1	Red	Diesel engine
	<sup>†</sup> Timing belt		74	14-1.4	1	Red	4JA1-T engine (RHD models)
	Diff. lock		74	14-1.4	1	Green	South Africa

#### RELAY AND FUSE BOX, FUSE BOX LOCATION



#### FUSE AND FUSIBLE LINK LOCATION (RELAY AND FUSE BOX)



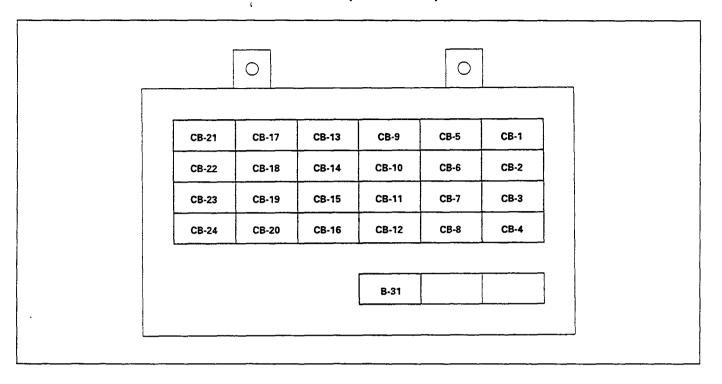
#### **FUSE**

NO. Engine model	4Z Series	4J Series	4JA1 (South Africa)
EB-1	15A HAZARD	15A HAZARD	15A HAZARD
EB-2	10A HORN	10A HORN	10A HORN
EB-3	-	•	-
EB-4	20A BLOWER	20A BLOWER	20A BLOWER
EB-5	10A AIR CON.	10A AIR CON.	10A AIR CON.
EB-6	-	-	-
EB-7	-	10A (CHARGE)	-
EB-8	10A H/LAMP-LH	10A H/LAMP-LH	10A H/LAMP-LH
EB-9	10A H/LAMP-RH	10A H/LAMP-RH	10A H/LAMP-RH
EB-10	-	-	-
EB-11	10A STOP	10A STOP	10A STOP
EB-12	15A TAIL	15A TAIL	15A TAIL
EB-13	-	-	-
EB-14	10A AUTO CHOKE	•	-

#### **FUSIBLE LINK**

NO. Engine model	4Z Series	4J Series	4JA1 (South Africa)
EB-15 .	40A IGN. BI	40A IGN. BI	40A IGN. BI
EB-16	80A MAIN	100A MAIN	80A MAIN
EB-17	50A GLOW	50A GLOW	50A GLOW
EB-18	-	-	-
EB-19	40A IGN. B2, POWER	40A IGN. B2, POWER	40A IGN. B2, POWER

#### **FUSE AND CIRCUIT BREAKER LOCATION (FUSE BOX)**



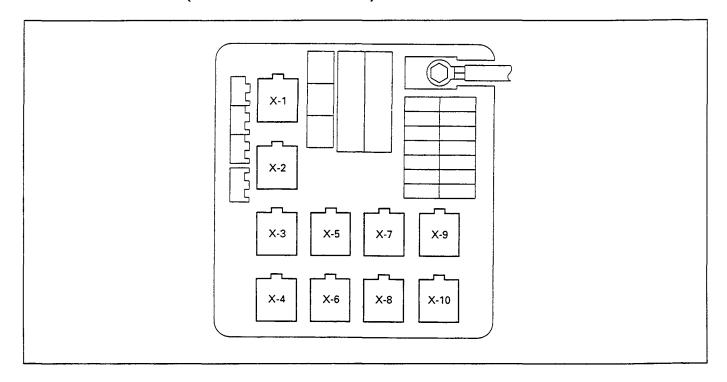
#### **FUSE**

No.	Capacity	Indication on label	No.	Capacity	Indication on label
CB-1	10A	STARTER	CB-13	10A	ROOM
CB-2		-	CB-14	20A	DOOR LOCK
CB-3	15A	ENGINE-1	CB-15	10A	DRIVING LIGHT
CB-4	10A	ENGINE-2	CB-16	-	-
CB-5	15A	METER	CB-17	5A	CELL EARTH (option)
CB-6	10A	DIFF LOCK	CB-18	-	•
CB-7	15A	AUDIO	CB-19	15A	CIGAR
CB-8	-	•	CB-20	-	-
CB-9	5A	CELL IGN (OPTION)	CB-21	-	-
CB-10	10A	TOW AUX	CB-22	-	-
CB-11	20A	WIPER	CB-23	5A	CELL POS (OPTION)
CB-12	15A	BACK TURN	CB-24	10A	V.S.S.

#### **CIRCUIT BREAKER**

No.	Capacity	Indication on label
B-31	30A	(POWER WINDOW)

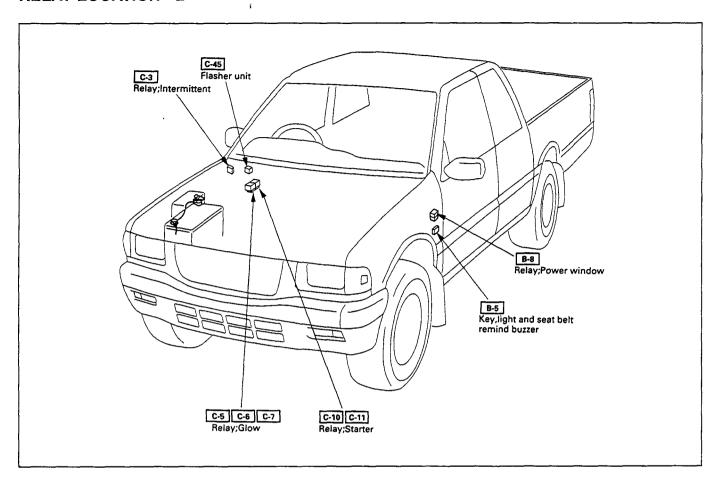
#### **RELAY LOCATION-1 (RELAY AND FUSE BOX)**



#### **RELAY**

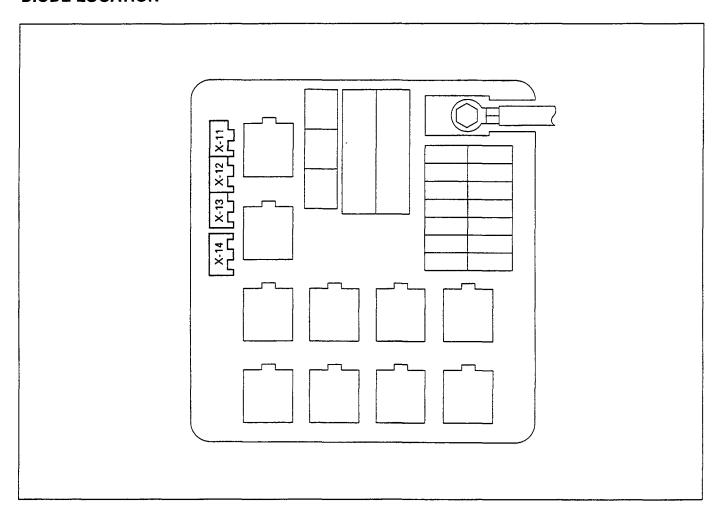
NO. Engine model	4Z Series	4JB1	4JA1
X-1	RELAY; LIGHTING	RELAY; LIGHTING	RELAY; LIGHTING
X-2	RELAY; TAIL	RELAY; TAIL	RELAY; TAIL
X-3	RELAY; HEATER	RELAY; HEATER	RELAY; HEATER
X-4	RELAY; HORN	RELAY; HORN	RELAY; HORN
X-5	RELAY; CHARGE	RELAY; CHARGE	-
X-6	RELAY; STARTER	-	RELAY; STARTER
X-7	(RELAY; THERMO)	(RELAY; THERMO)	(RELAY; THERMO)
X-8	-	-	RELAY; ST. CUT
X-9	-	(RELAY; CSD)	(RELAY; CSD)
X-10	-	<u>-</u>	•

#### **RELAY LOCATION - 2**

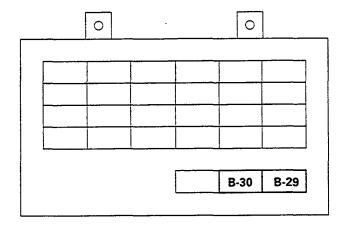


Connector No.	C-3	C-5	C-6	C-7	C-10	C-11	B-8
Relay Engine model	WINDSHIELD INTERMITTENT	C	SLOW	-	STAF	RTER	POWER WINDOW
4Z Series	0					-	0
4J Series	0		0			)	0

#### **DIODE LOCATION**

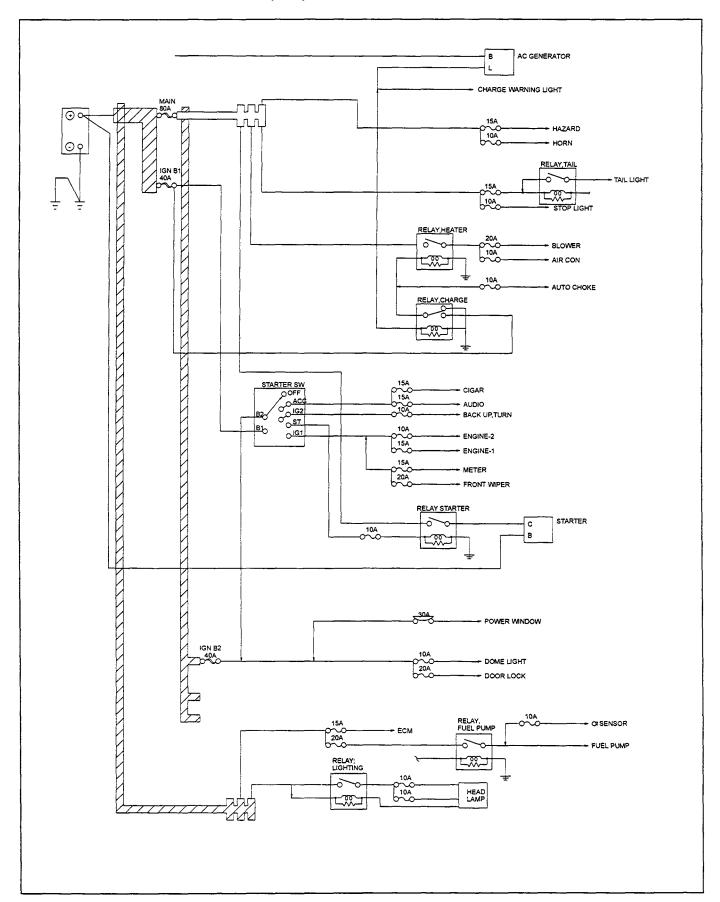


#### **FUSE BOX (RHD)**

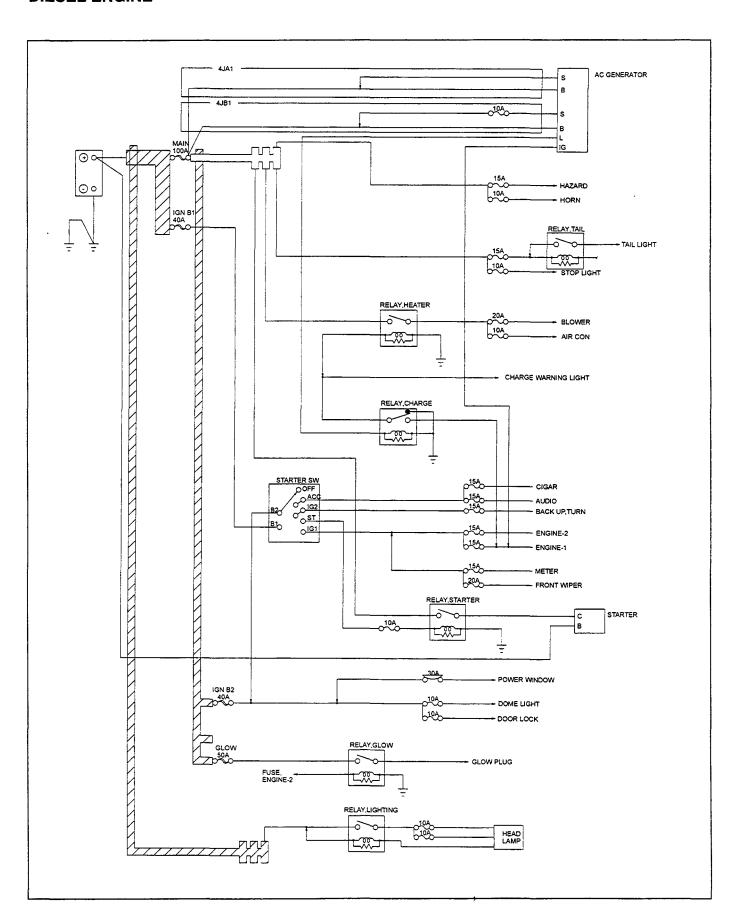


Connector No.	X-11	X-12	X-13	X-14	B-29	B-30
Usage Engine model	-	_	-	-	-	Buzzer warning
4Z Series	-	-	-	-	-	0
4J Series	-	-	-	-	_	0

#### FUSE BLOCK CIRCUIT PETROL ENGINE EXCEPT 4ZE1 (MPI) ENGINE



#### FUSE BLOCK CIRCUIT DIESEL ENGINE



#### REFERENCE TABLE OF FUSE, FUSIBLE LINK AND CIRCUIT BREAKER - PERTOL ENGINE

FUSE (Relay and fuse box)

Fuse No.	Capacity	Indication on label	Parts (load)
EB-1	15A	HAZARD	Hazard SW, Flasher unit
EB-2	10A	HORN	Horn relay, Horn SW, Horn
EB-3	-	-	-
EB-4	20A	BLOWER	Blower motor, A/C thermo relay, Blower resistor
EB-5	10A	AIR CON.	Pressure SW, A/C SW, Electrical thermostat, Fan SW, Magnetic clutch, FICD, A/C thermo relay
EB-6	-	-	-
EB-8	10A	H/LAMP-LH	Headlight-LH, High beam indicator light, Dimmer - passing SW
EB-9	10A	H/LAMP-RH	Headlight-RH, Dimmer - passing SW
EB-10	-	-	-
EB-11	10A	STOP	Stop light SW, Stop light, High mounted stop light
EB-12	15A	TAIL	Tail relay, Clearance light, Tail light, License plate light, Illumination controller, Illumination lights, Lighting SW
EB-14	10A	AUTO CHOKE	Auto choke (4ZD1 (CARB)), Vent SW valve (4ZD1 (CARB))

#### FUSE (Fuse box)

Fuse No.	Capacity	Indication on label	Parts (load)
CB-1	10A	STARTER	Starter relay, ST. cut relay (4ZE1 (MPI)), ECM
CB-2	-	-	-
CB-3	15A	ENGINE-1	Ignition coil, Power SW, Distributor, Engine speed sensor
CB-4	10A	ENGINE-1	ECM main relay, Engine speed sensor, Slow cut solenoid (4ZD1 (CARB), 4ZE1 (CARB)), Neutral SW (4ZC1 (CARB), 4ZD1 (CARB)), Coasting richer (4ZC1 (CARB), 4ZD1 (CARB)), 2ND SW (4ZD1 (CARB)), TOP-3RD SW (4ZD1 (CARB)), VSV; Air (4ZD1 (CARB)), Clutch SW (4ZD1 (CARB)), Accel SW (4ZD1 (CARB))
CB- <u>5</u>	15A	METER	Vehicle speed sensor, Meter gauges, Indicator and warning lights, Overdrive off relay (A/T), Overdrive solenoid (A/T), Overdrive off SW (A/T), Key, Light & seat belt remind buzzer (SOUTH AFRICA), RR defogger relay, RR defogger SW, AC generator, Seat belt SW (SOUTH AFRICA)
CB-6	10A	DIFF LOCK	Diff lock switch, Diff, Solenoid
CB-7	15A	AUDIO	Audio
CB-9	5A	CELL IGN	Ignition switch
CB-10	10A	TOW AUX	Tow plug, Combination lamps
CB-11	20A	WIPER	Windshield wiper & washer SW Windshield wiper motor, Windshield washer motor, Windshield intermittent relay
CB-12	15A	BACK UP, TURN	Power window relay, FRT power window & door lock SW-driver side, RR power window SW, Hazard SW, Flasher unit, Turn signal SW, Back up light SW (M/T), Back up light, Mode SW (A/T)
CB-13	10A	DOME LIGHT	Dome light, Spot light, Door SW, Audio, Clock
CB-14	20A	DOOR LOCK	FRT power window & door lock SW-driver side, Door lock SW-driver side, Door lock actuator
CB-15	10A	DRIVING LIGHT	Driving light switch, Driving lights, Driving light relay, Combination switch

Fuse No.	Capacity	Indication on label	Parts (load)
CB-16	-	-	•
CB-17	5A	CELL EARTH (option)	Cell earth to LHD kick panel
CB-18	-	-	-
CB-19	15A	CIGAR	Cigarette lighter, Clock
CB-20	-	-	-
CB-21	-	-	-
CB-22	-	-	-
CB-23	5A	CELL POS (option)	Fuse box
CB-24	10A	V.S.S.  VEHICLE SECURITY SYSTEM	V.S.S. unit, AM key/jack plug, LED, Anti hijack (option) Ultrasonic signal (option), Central door locking, CDL unit, Turn signal left/right, Speed sensor, V.S.S. bonnet switch, Alarm horn (option), Relay starter, Program option connector, Mechanical door switch, Room lamp

#### **FUSIBLE LINK**

(Relay and fuse box)

Fuse Link No.	Capacity	Indication on label
EB-15	40A	IGN. B1
EB-16	80A	MAIN
EB-17	-	-
EB-18	-	-
EB-19	40A	IGN. B2, POWER

### **CIRCUIT BREAKER**

(Fuse box)

Fuse No.	Capacity	Indication on label	Parts (load)
B-31	30A	(POWER WINDOW)	Power window & door lock SW, Power window motor, Power window relay

## DIESEL ENGINE FUSE (Relay and fuse box)

Fuse Link No.	Capacity	Indication on label	Parts (load)
EB-1	15A	HAZARD	Hazard SW, Flasher unit
EB-2	10A	HORN	Horn relay, horn SW, Horn
EB-3	_	_	-
EB-4	20A	BLOWER	Blower motor, A/C thermo relay, Blower resistor
EB-5	10A	AIR CON.	Pressure SW, A/C SW, Electronic thermostat, Fan SW, Magnetic clutch, VSV, FICD, A/C thermo relay
EB-6	_	_	-
EB-7	10A	(CHARGE)	AC generator, Charge relay
EB-8	10A	H/LAMP-LH	Headlight-LH, High beam indicator light, Dimmer • passing SW
EB-9	10A	H/LAMP-RH	Headlight-RH, Dimmer • passing SW
EB-10	-	_	_
EB-11	10A	STOP	Stop light SW, Stop light, High mounted stop light
EB-12	15A	TAIL	Tail relay, Clearance light, Tail light, License plate light, Illumination lights, Lighting SW, Illumination controller
EB-13	_	_	-
EB-14	-	_	_

## FUSE (Fuse box)

Fuse No.	Capacity	Indication on label	Parts (load)
CB-1	10A	STARTER	QOS-II control unit, Starter relay, ST. cut relay (4JA1)
CB-2	-	-	-
CB-3	15A	ENGINE-1	CSD relay, Fuel cut solenoid, Thermo SW, CSD solenoid, AC generator, Charge relay
CB-4	10A	ENGINE-2	QOS-II control unit, Glow relay
CB-5	15A	METER	Vehicle speed sensor, Meter gauges, Indicator and warning lights, QOS-II control unit, RR defogger relay, RR defogger SW, Key, light & seat belt remind buzzer (SOUTH AFRICA), Seat belt SW (SOUTH AFRICA)
CB-6	10A	DIFF LOCK	Diff lock switch, Diff, Solenoid
CB-7	15A	AUDIO	Audio, Door mirror control SW, Mirror
CB-9	5A	CELL IGN	Ignition switch
CB-10	10A	TOW AUX	Tow plug, Combination lamps
CB-11	20A	WIPER	Windshield wiper & washer SW Windshield wiper motor, Windshield washer motor, Windshield intermittent relay
CB-12	15A	BACK UP, TURN	Power window relay, FRT power window & door lock SW-driver side, RR power window SW, Hazard SW, Flasher unit, Turn signal SW, Back up light SW (M/T), Back up light, Mode SW (A/T)
CB-13	10A	DOME LIGHT	Dome light, Spot light, Door SW, Audio, Clock
CB-14	20A	DOOR LOCK	FRT power window & door lock SW-driver side, Door lock SW-driver side, Door lock actuator
CB-15	10A	DRIVING LIGHT	Driving light switch, Driving lights, Driving light relay, Combination switch
CB-16	-	-	-
CB-17	5A	CELL EARTH (option)	Cell earth to LHD kick panel
CB-18	-	-	-
CB-19	15A	CIGAR	Cigarette lighter, Clock

Fuse No.	Capacity	Indication on label	Parts (load)
CB-21	-	-	•
CB-22	-	-	-
CB-23	5A	CELL POS (option)	Fuse box
CB-24	10A	V.S.S. VEHICLE SECURITY SYSTEM	V.S.S. unit, AM key/jack plug, LED, Anti hijack (option), Ultrasonic signal (option), Central door locking, CDL unit, Turn signal left/right, Speed sensor, V.S.S. bonnet switch, Alarm horn (option), Relay starter, Program option connector, Mechanical door switch, Room lamp

#### 8 – 38 ELECTRICAL-BODY AND CHASSIS

### **FUSIBLE LINK**

(Relay and fuse box)

Fuse Link No.	Capacity	Indication on label
EB-15	40A	IGN. B1
EB-16	100A	MAIN
EB-17	-	-
EB-18	-	<del>-</del>
EB-19	40A	IGN. B2, POWER

#### **CIRCUIT BREAKER**

(Fuse box)

Fuse No.	Capacity	Indication on label	Parts (load)
B-31	30A	(POWER WINDOW)	Power window & door lock SW, Power window motor, Power window relay

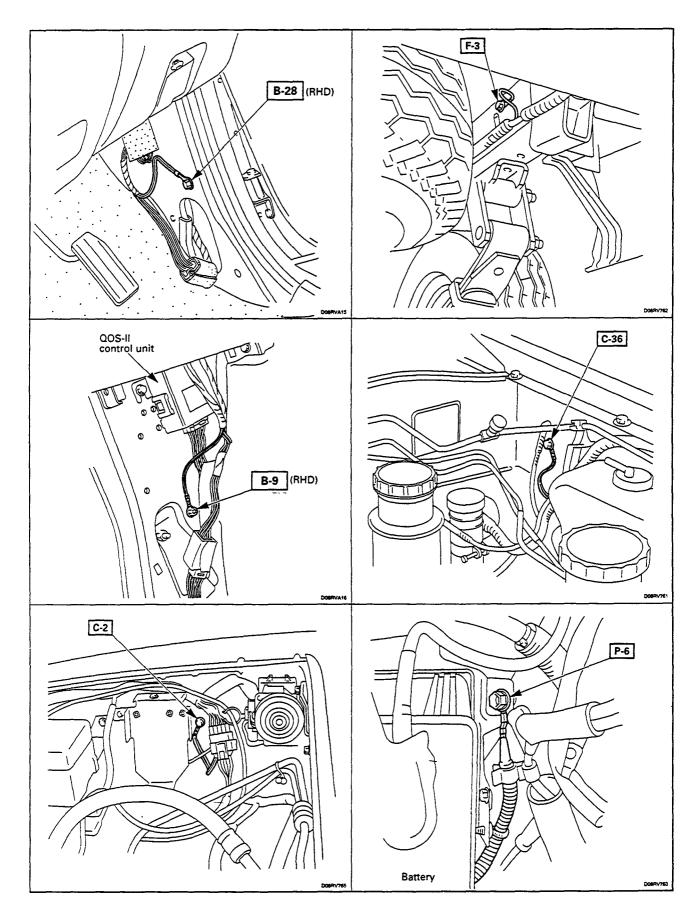
## GROUNDING POINT REFERENCE TABLE (PETROL ENGINE)

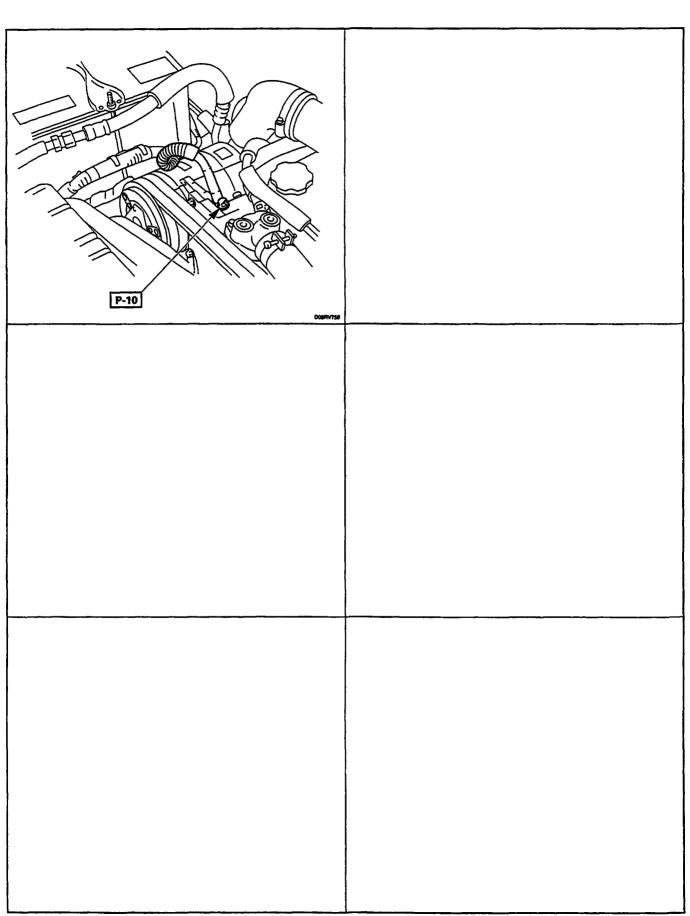
Connector No.	Cable harness	Location	Parts (load)
B-9		Body-LH	Fan SW, FRT power window & door lock SW- passenger side, RR power window SW, Key, light & seat belt remind buzzer (SOUTH AFRICA)
B-28	Body harness	Body-RH	Illumination light (Meter, Heater & A/C control panel, Cigarette lighter, Ashtray, RR defogger SW, Audio, Hazard SW), Illumination controller, Turn signal indicator light, Power window relay, Door mirror control SW, RR defogger, RR defogger SW, Door lock SW-driver side, Audio, Clock, Cigarette lighter
C-2	Engine room harness	Fender-RH	Vehicle speed sensor, 4WD SW, Brake fluid level SW, Heater relay, Dimmer-passenger SW, Lighter SW, Overdriver off SW (4ZE1, A/T), Charge relay, Idle SW (4ZE1), Accel SW (4ZC1, 4ZD1), Engine speed sensor, Starter relay, Windshield intermittent relay, ST. cut relay (4ZE1, A/T), Windshield wiper motor, Flasher unit, Side turn signal light-RH, Mode SW (4ZE1, A/T)
C-36	namess	Fender-LH	Speedometer, Fuel tank unit, Tachometer (W/Tachometer), Engine coolant temperature gauge (W/Tachometer), Fuel gauge, Clearance light, Seat belt SW (SOUTH AFRICA), Windshield washer motor, Side turn signal light-LH, FRT turn signal light
F-3	Chassis harness	Frame	Tail light, License plate light, Fuel pump, Stop light, RR turn signal light, Back up light

## (DIESEL ENGINE)

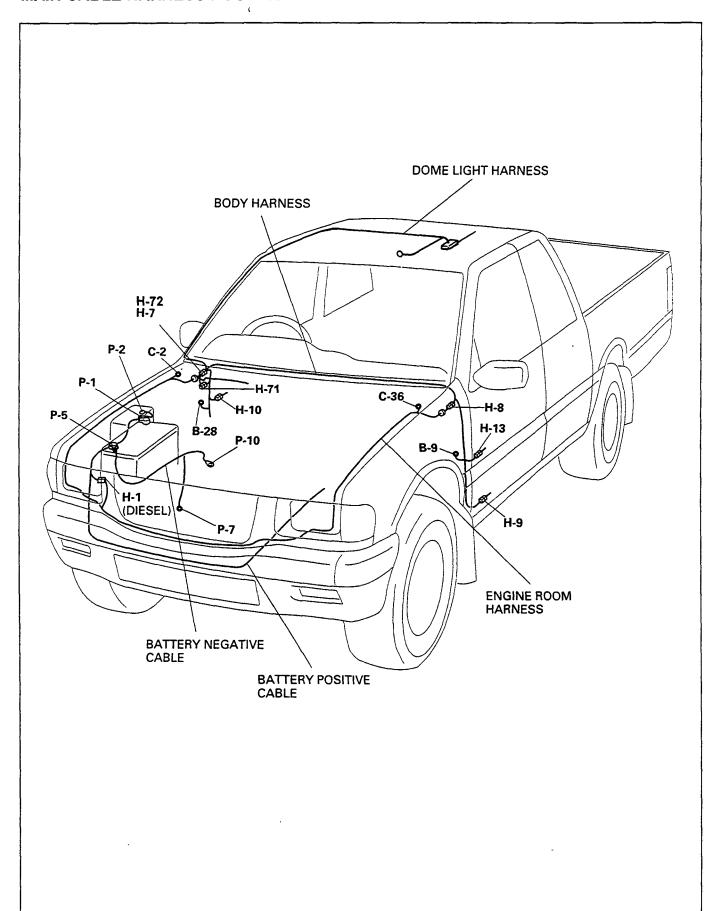
Connector No.	Cable harness	Location	Parts (Load)
B-9		Body-LH	Fan SW, FRT power window & door lock SW- passenger side, RR power window SW, Key, light & seat belt remind buzzer (SOUTH AFRICA)
B-28	Body harness	Body-RH	Turn signal indicator light, Illumination light (Meter, Heater & A/C control panel, Cigarette lighter, Ashtray, RR defogger SW, Audio, Hazard SW), Illumination controller, FRT power window & door lock SW-driver side, Power window relay, Door mirror control SW, RR defogger, RR defogger SW, FRT door lock SW-driver side, Audio, Clock, Cigarette lighter
C-2	Fender-RH		Vehicle speed sensor, 4WD SW, Brake fluid level SW, Tacho sensor, Heater relay, VSV; FICD, Dimmer-passing SW, Lighting SW, QOS-II control unit, Starter relay, Charge relay, Windshield intermittent relay, Windshield wiper motor, ST. cut relay (4JA1, SOUTH AFRICA), Side turn signal light-RH, Flasher unit
C-36	Engine room harness	Fender-LH	Speedometer, Fuel tank unit, Fuel filter SW, Tachometer (W/Tachometer), Engine coolant temperature gauge (W/Tachometer), Fuel gauge, Timing belt warning light, Fuel filter SW, Clearance light, Seat belt SW (SOUTH AFRICA), Windshield washer motor, Side turn signal light-LH, FRT turn signal light
F-3	Chassis harness	Frame	Tail light, License plate light, Stop light, RR turn signal light, Back up light

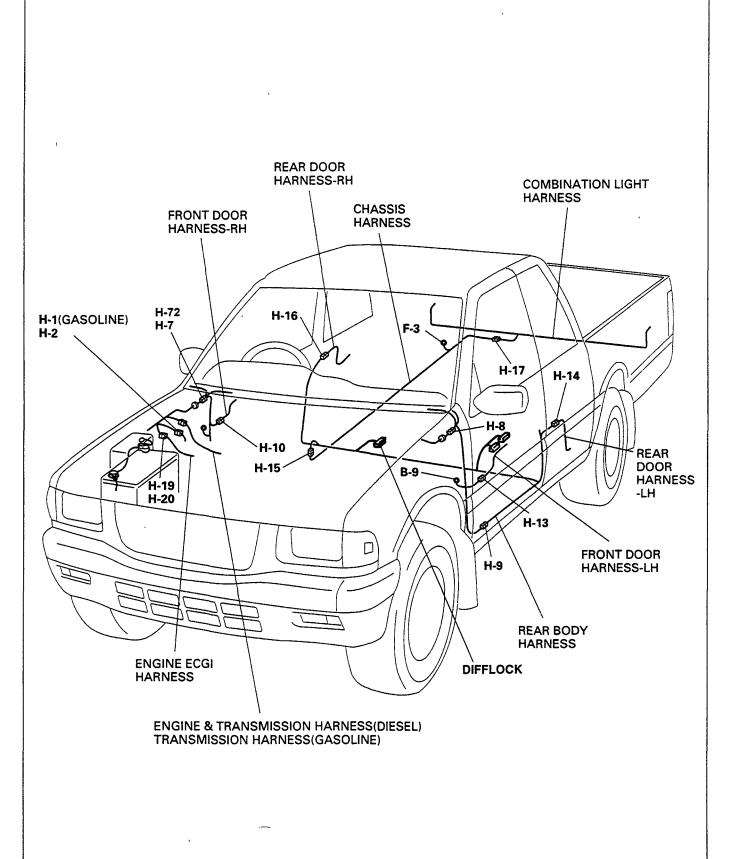
## GROUNDING POINT LOCATION





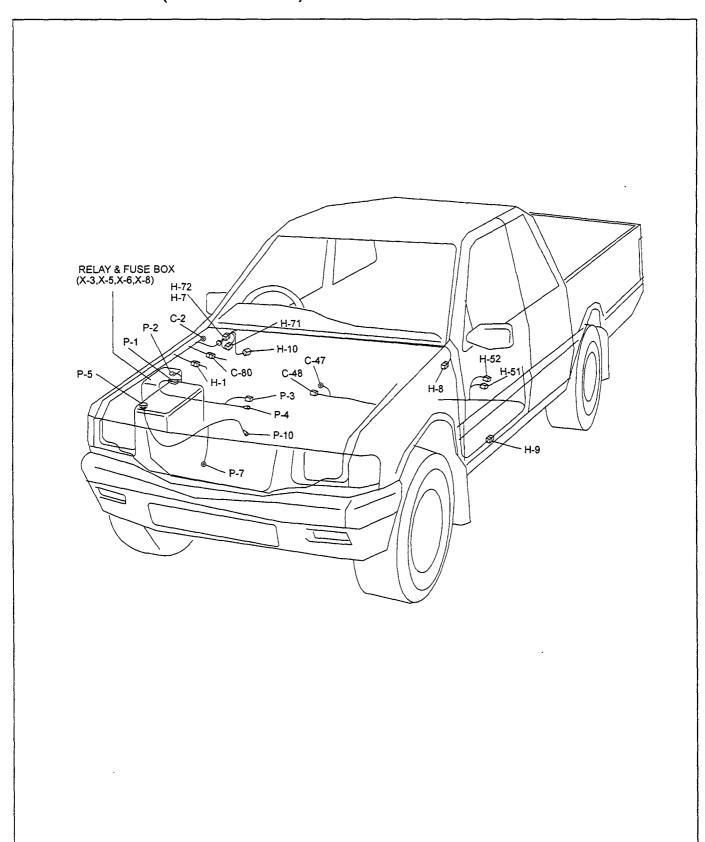
### MAIN CABLE HARNESS ROUTING



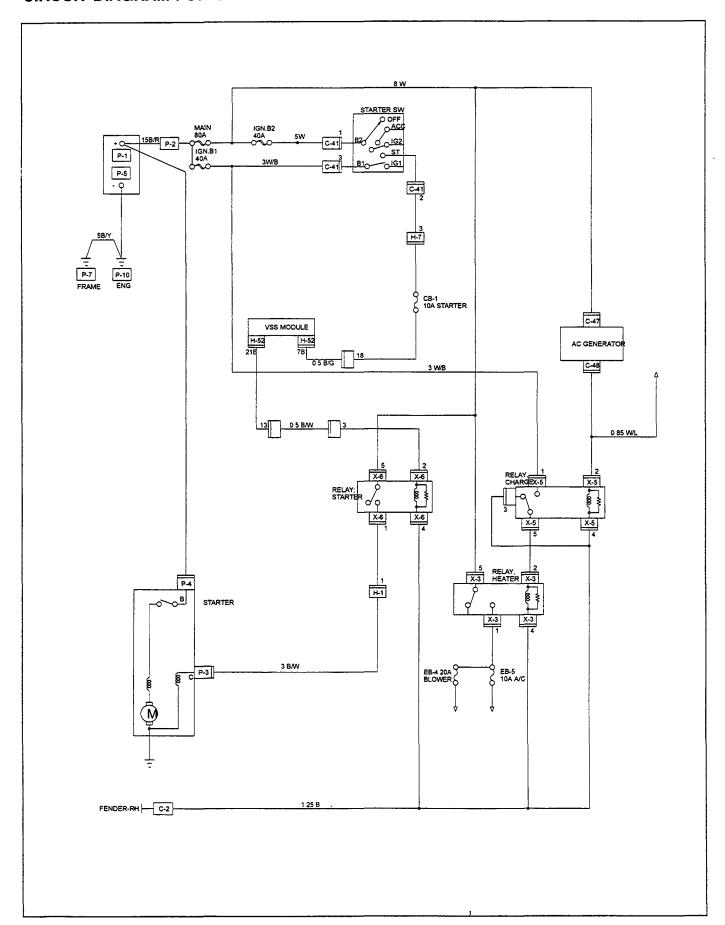


# SYSTEM REPAIR START AND CHARGING

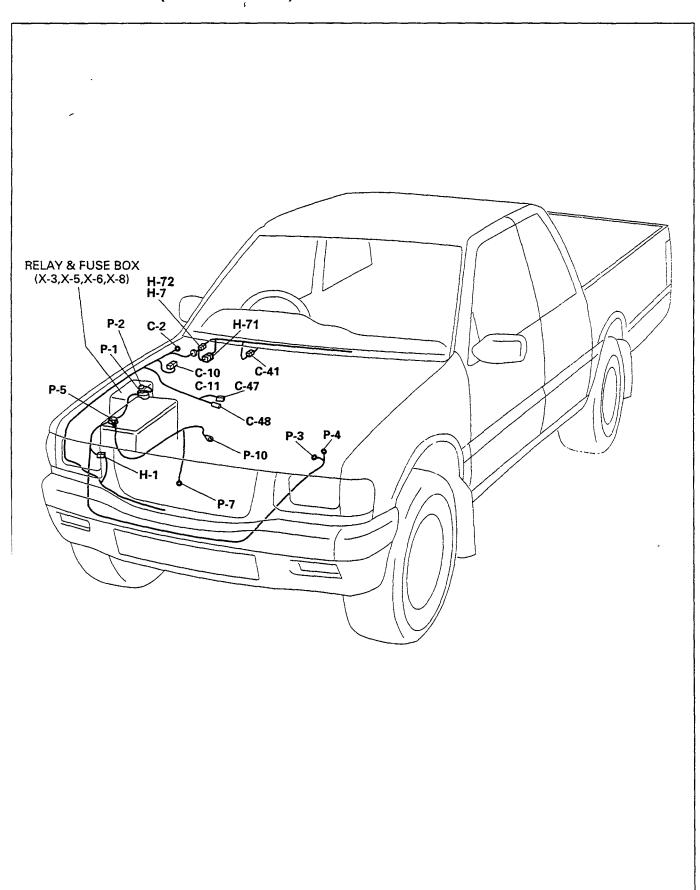
## **PARTS LOCATION (PETROL ENGINE)**



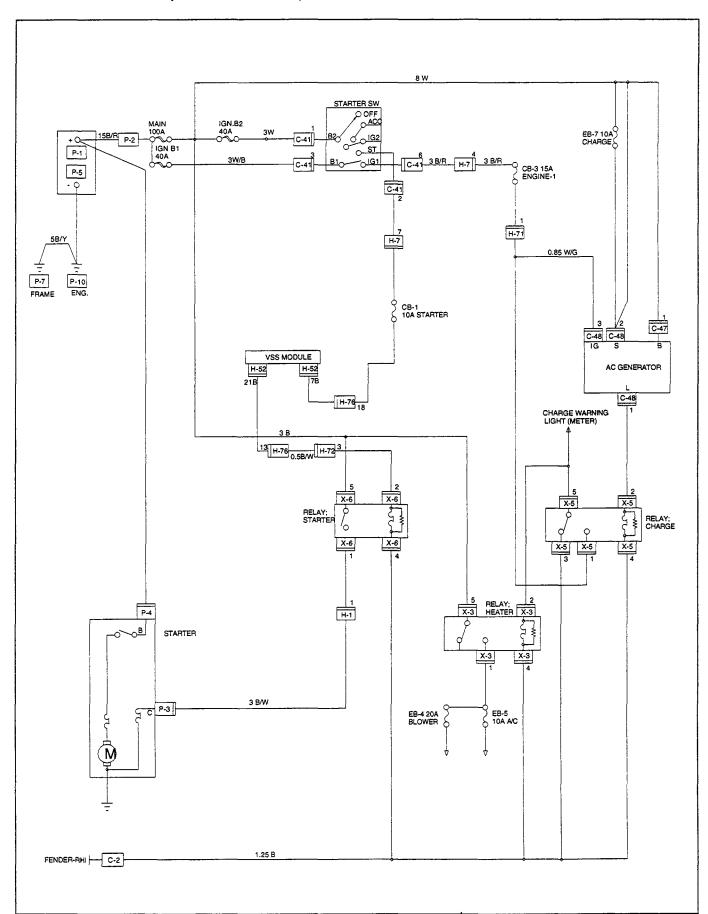
## CIRCUIT DIAGRAM FOR START AND CHARGE



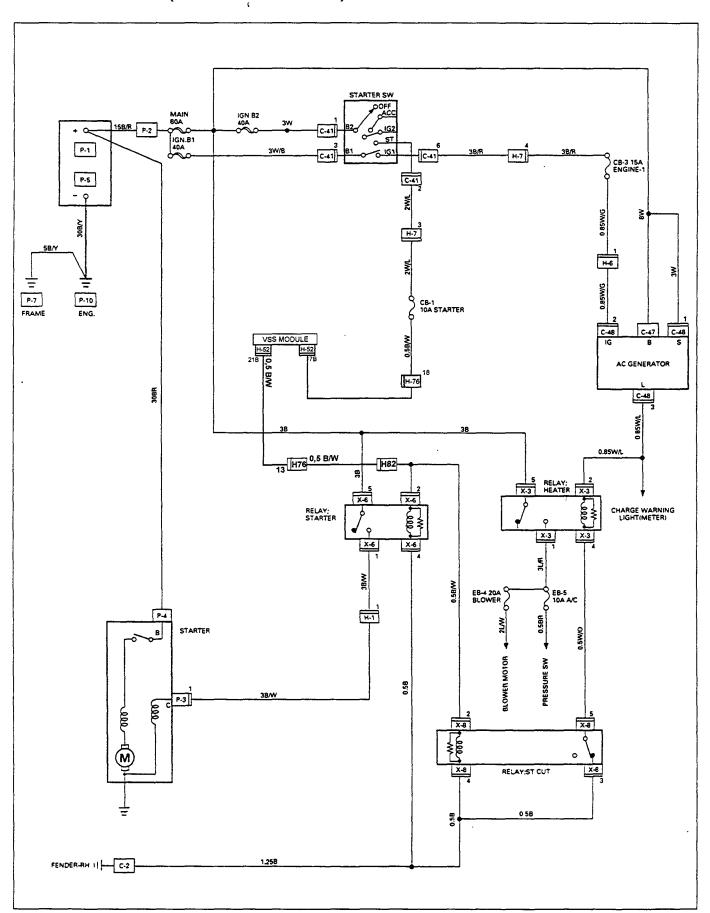
## PARTS LOCATION (DIESEL ENGINE)



## **CIRCUIT DIAGRAM (DIESEL ENGINE)**



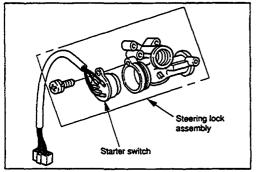
## **CIRCUIT DIAGRAM (4JA1 DIESEL ENGINE)**







## **REMOVAL AND INSTALLATION**





#### STARTER SWITCH

#### Removal

- 1. Steering Lock Assembly
  - Refer to Section 3B" STEERING COLUMN" for steering lock assembly removal steps.
- 2. Starter Switch

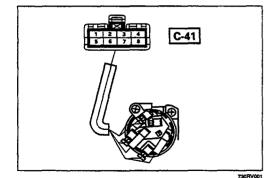
730RS005



#### Installation

Follow the removal procedure in the reverse order to install the starter switch.

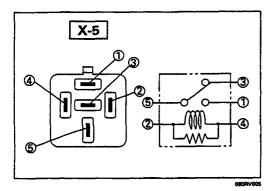
## INSPECTION AND REPAIR



#### **STARTER SWITCH**

#### **Switch Connections**

Starter switch ke position	Terminal No.	1 (B2)	(ACC)	8 (IG2)	2 (ST)	3 (B1)	6 (IG1)
LOCK	Removed						
LOCK							
OFF							
ACC	Inserted	0	-0				
ON		0	0	-0		0	0
START		0		<del>-</del>	-0	0-	0





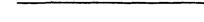
#### Charge relay (Diesel engine)

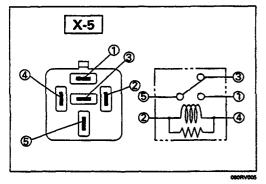
Check continuity between the relay terminals.

3-5	 Continuity
1 - 5	 No continuity

(When battery voltage is applied between ② and ④)

3-5	 No continuity
1-5	 Continuity







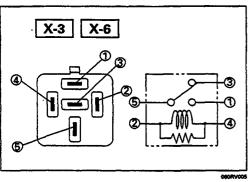
#### Charge relay (Gasoline engine except 4ZE1 (MPI))

Check continuity between the relay terminals.

① - ⑤ ..... No continuity

(When battery voltage is applied between ② and ④)

① - ⑤ ..... Continuity





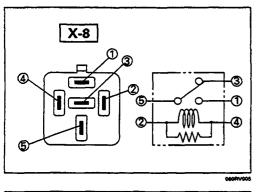
#### Starter relay (Gasoline engine), Heater relay

Check continuity between the relay terminals.

① - ⑤ ..... No continuity

(When battery voltage is applied between ② and ④)

① - ⑤ ...... Continuity





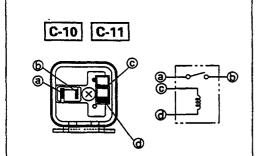
#### St. cut relay

Check continuity between the relay terminals.

3-5 ..... Continuity

(When battery voltage is applied between 2 and 4)

③ - ⑤ ...... No continuity





#### Starter relay (Diesel engine)

Check continuity between the relay terminals.

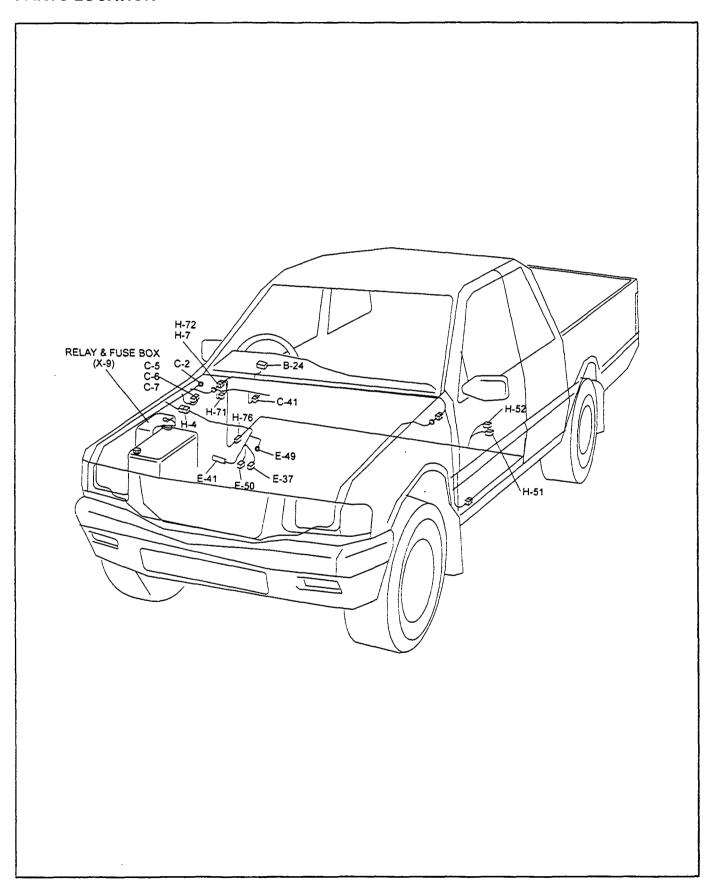
a - b ...... No continuity

(When battery voltage is applied between © and (d))

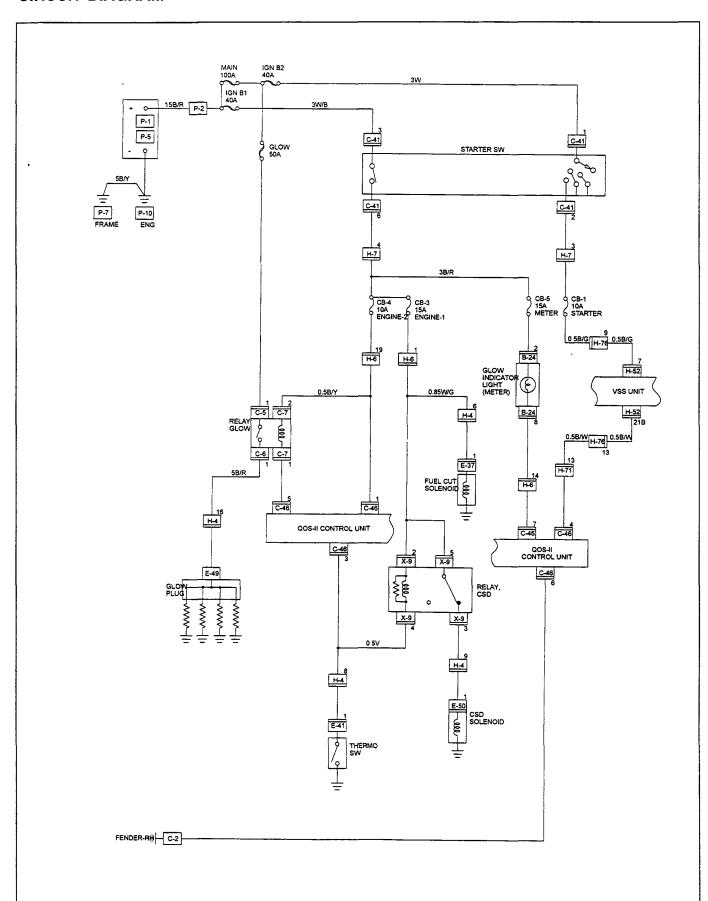
ⓐ − ⓑ ..... Continuity

## QOS SYSTEM (QUICK ON START)

#### **PARTS LOCATION**

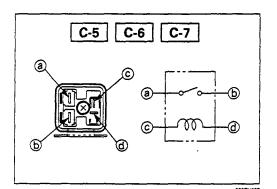


#### **CIRCUIT DIAGRAM**





## **INSPECTION AND REPAIR**





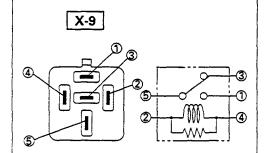
#### Glow relay

Check continuity between the relay terminals.

**a** - **b** ...... No continuity

(When battery voltage is applied between © and @)

**a** - **b** ..... Continuity





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#### **CSD** relay

Check continuity between the relay terminals.

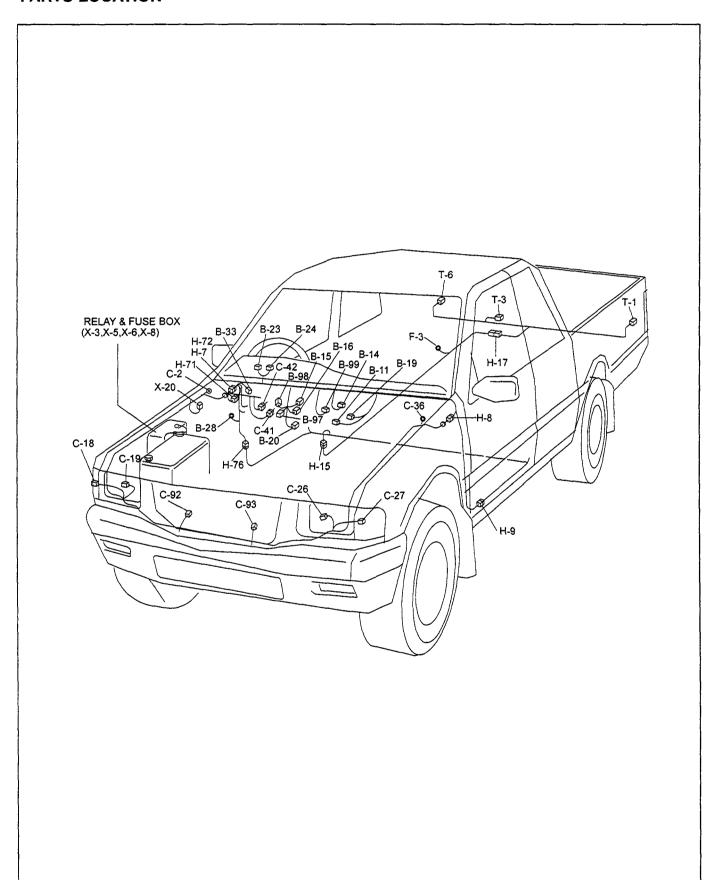
3-5 ..... Continuity

(When battery voltage is applied between ② and ④)

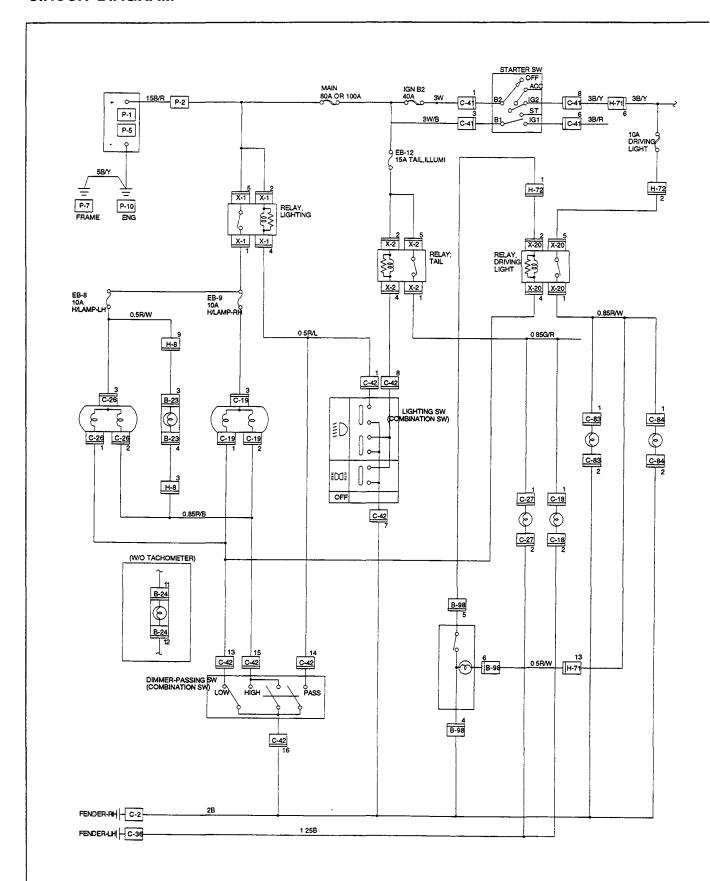
③ – ⑤ ...... No continuity

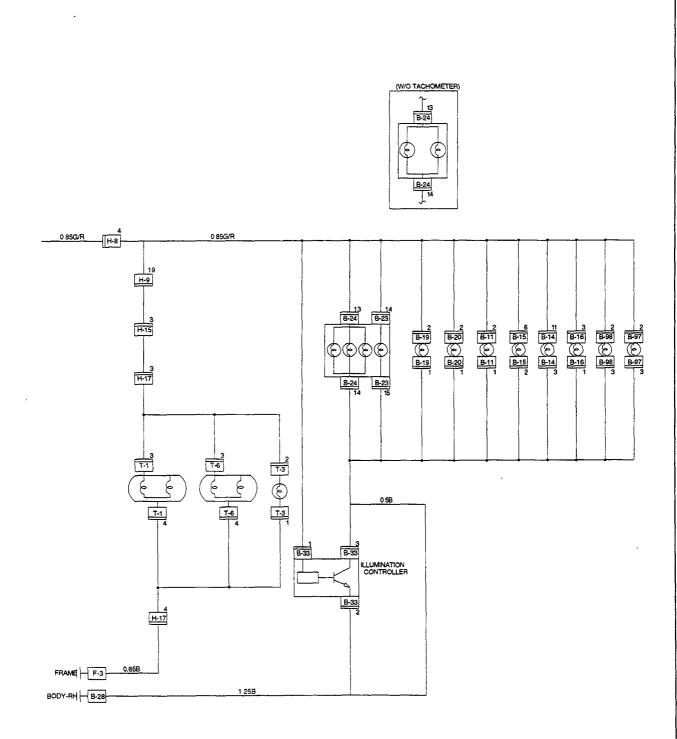
## LIGHTING

#### PARTS LOCATION



### **CIRCUIT DIAGRAM**

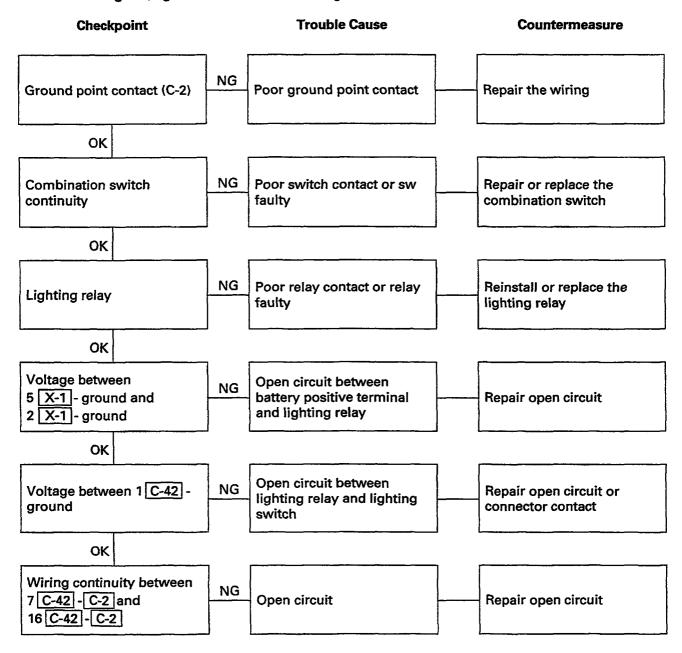




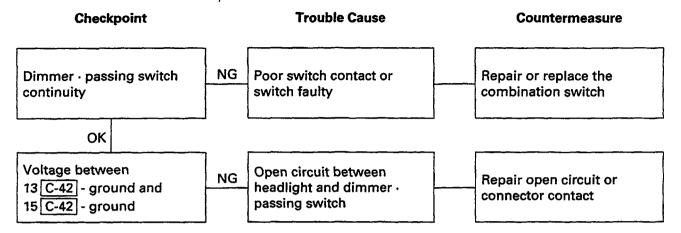
#### **TROUBLESHOOTING**

#### HEADLIGHT

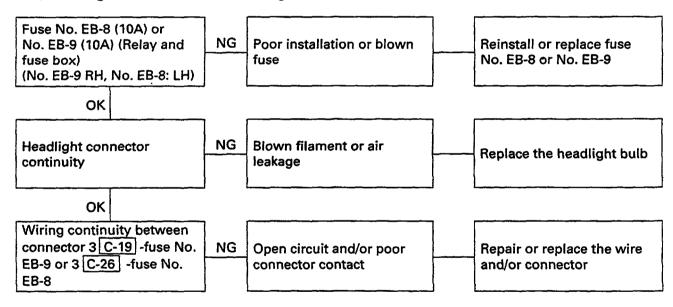
1. Both the headlights (high and low beam) do not light



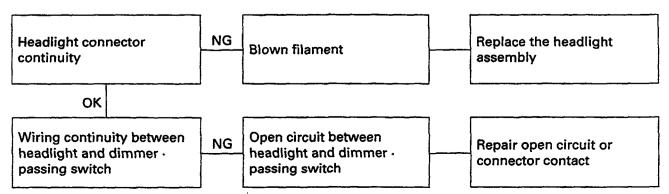
#### 2. High or low beam does not light on both headlights



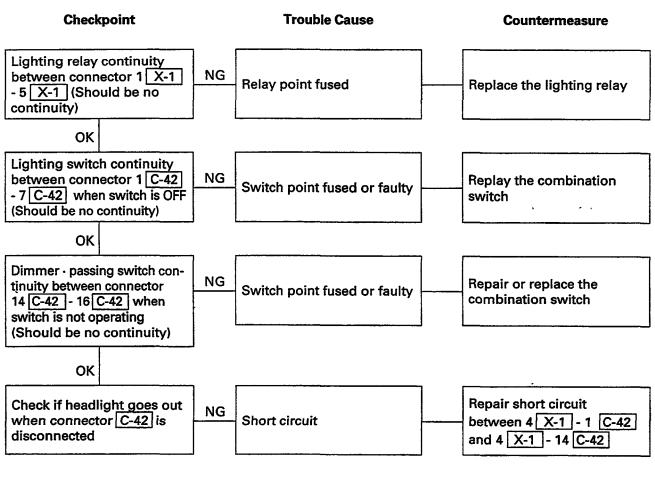
#### 3. RH (or LH) high and low beam does not light



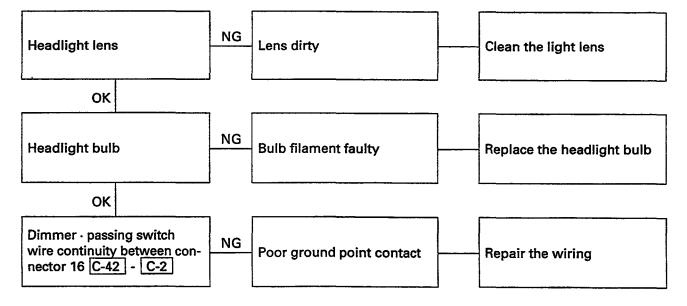
#### 4. High or low beam does not light on one headlight (RH or LH)



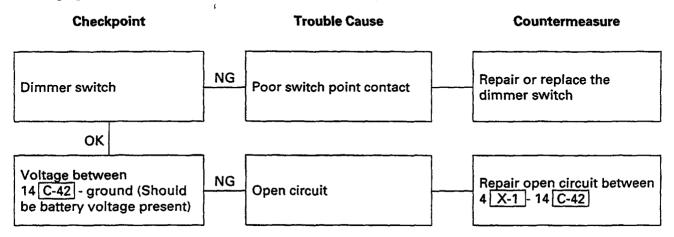
#### 5. Headlight does not go out



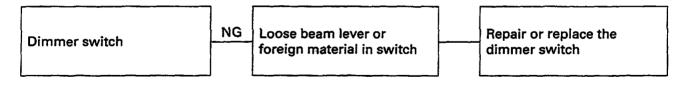
#### 6. Insufficient headlight brightness



#### 7. Passing light does not function when dimmer switch is operated

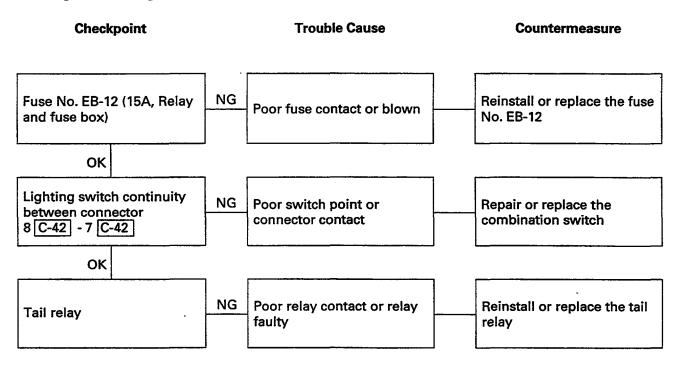


#### 8. Headlight beam does not change when dimmer switch is operated

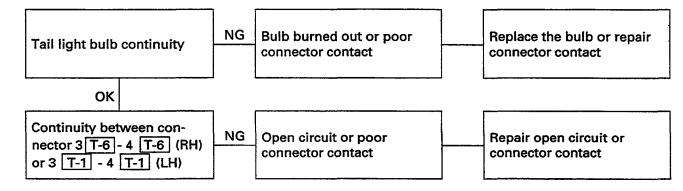


## TAIL LIGHT, LICENSE PLATE LIGHT, CLEARANCE LIGHT AND ILLUMINATION CONTROLLER

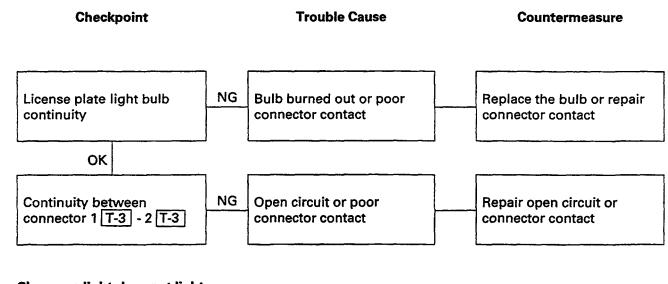
#### 1. All lights do not light



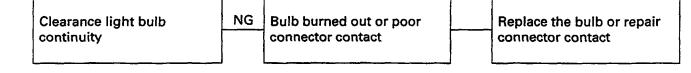
### 2. Tail light does not light



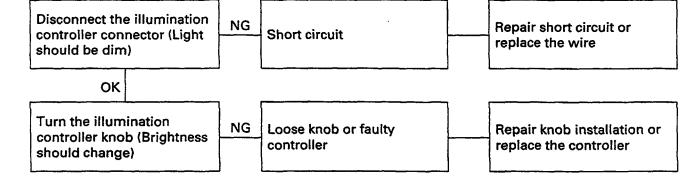
#### 3. License plate light does not light



## 4. Clearance light does not light

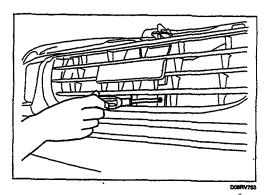


## 5. Illumination controller does not operate





## **→**← REMOVAL AND INSTALLATION

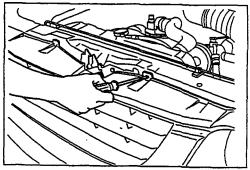


### **HEADLIGHT**

## **+**+

#### Removal

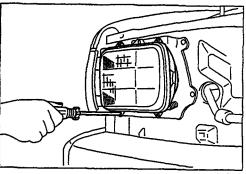
1. Remove the radiator grille center bolt.



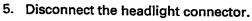
2. Use a screwdriver to raise the clip and release the lock.

Place a clean rag beneath the screwdriver tip to protect the body painted surfaces.

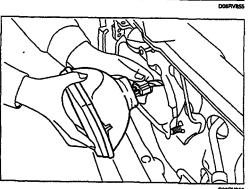
3. Remove the radiator grille.



4. Remove the headlight rim.



6. Remove the headlight.





#### Installation

Follow the removal procedure in the reverse order to install the headlight.

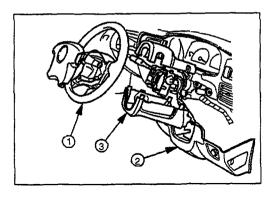


Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

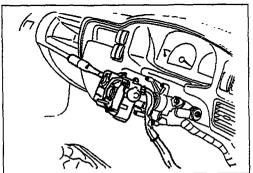
Be absolutely sue that the headlight connector is securely connected.

This will prevent a contact and an open circuit.



## LIGHTING SWITCH Removal

- 1. Remove the steering wheel (1).
- 2. Remove the Instrument panel lower cover (2).
- 3. Remove the steering column cover (3).



- 4. Disconnect the connector.
- 5. Remove the lighting switch from the steering shaft.



#### Installation

Follow the removal procedure in the reverse order to install the lighting switch.



Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

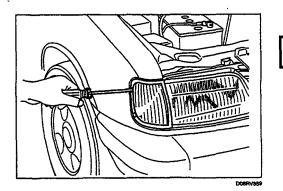
Be absolutely sure that the lighting switch connector is securely connected.

This will prevent a poor contact and an open circuit.

#### **Wire Harness**

Do not pinch the wire harnesses between the cluster and the meter hood during the cluster installation procedure.

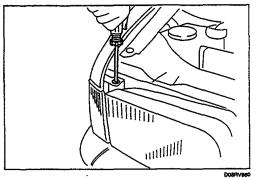
Wire damage will result.



#### **CLEARANCE LIGHT**

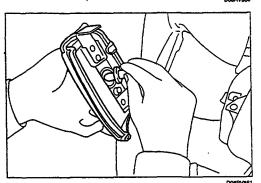
#### Removal

- 1. Remove the radiator grille. (Refer to headlight removal procedure.)
- 2. Remove the side screws.



3. Remove the top screw.

- 4. Turn the socket counterclockwise to disconnect it from the clearance light housing.
- 5. Pull the bulb from the socket.





#### Installation

Follow the removal procedure in the reverse order to install the clearance light.

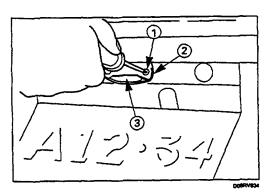


Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

Be absolutely sure that the clearance light connector is securely connected.

This will prevent a poor contact and an open circuit.



#### LICENSE PLATE LIGHT

#### Removal



- 1. Loosen the screws ①.
- 2. Remove the lens cover ② and the lens ③.
- 3. Pull the bulb to remove it.



#### Installation

Follow the removal procedure in the reverse order to install the license plate light.

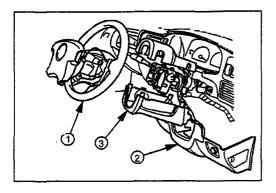


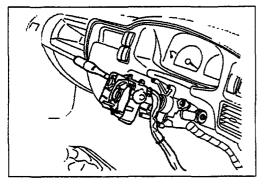
Pay close attention to the important points mentioned in the following paragraphs.

#### Bulb

Be absolutely sure that the license plate light bulb is correctly installed.

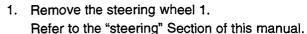
This will prevent a poor contact and an open circuit.







#### Removal



- 2. Remove the instrument panel lower cover 2.
- 3. Remove the steering column cover 3.
- 4. Disconnect the connector.
- 5. Remove the headlight beam switch (lever ) from the steering shaft.



#### Installation

Follow the removal procedure in the reverse order to install the headlight beam switch (lever).



Pay close attention to the important pints mentioned in the following paragraphs.

#### Connector

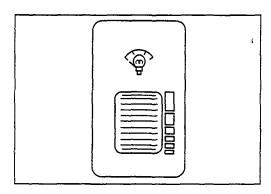
Be absolutely sure that the headlight beam switch connector is securely connected.

This will prevent a poor contact and an open circuit.

#### Wire Harness

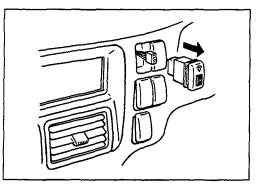
Do not pinch the wire harnesses between the cluster and the metre hood during the cluster installation procedure.

Wire damage will result.



#### **ILLUMINATION CONTROLLER**

Turning the illumination controller knob upward increases the brightness of each illumination light, turning it downward decreases its brightness.





#### Removal

- Instrument Panel Cluster Assembly
  Refer to Section 10 "BODY" for instrument panel
  cluster assembly removal steps.
- 2. Illumination Controller
  - Disconnect the switch connector.
  - To remove the switch, push the lock from the back side of the cluster assembly.



#### Installation

To install, follow the removal procedure in the reverse order.

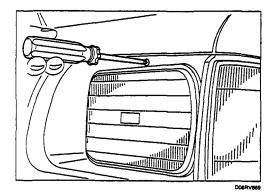
# Connector

Be absolutely sure that the illumination controller connector is securely connected.



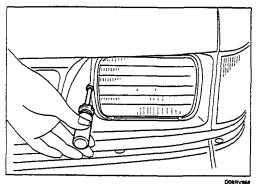
# **AIMING OF HEADLIGHT**

Check and adjust the inflation pressures, clean the headlight lenses, park the vehicle on a level surface and insure that vehicle is at curb weight.



### **VERTICAL ADJUSTMENT**

Use a screwdriver for vertical adjustment.

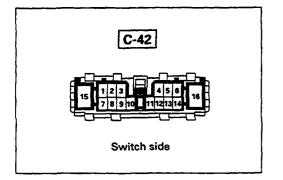


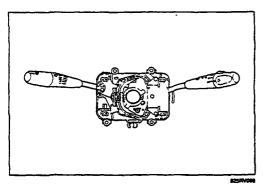
# HORIZONTAL ADJUSTMENT

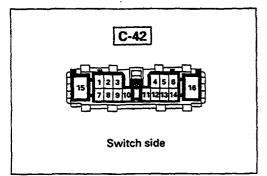
Use a screwdriver horizontal adjustment.

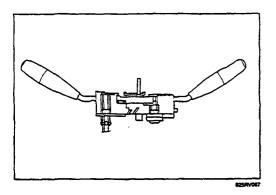


# **INSPECTION AND REPAIR**









# **LIGHTING SWITCH**

# **Lighting Switch Connections**

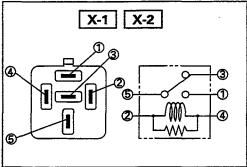
Terminal No. position	1	7	8
OFF			
Tail		0-	0
<b>\$</b>		0	0
Headlight	0-	<b>-</b>	9

# **HEADLIGHT BEAM SWITCH**

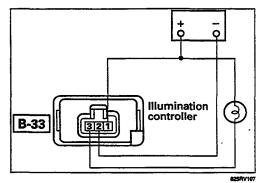
# **Headlight Beam and Passing Switch Connections**

Termi SW position	16	13	15	14	
A4 #Di	н	0		0	
At "Dimmer" position	LO	0-	-0		
At "Passing" position				-0-	0

#### 8 - 74 ELECTRICAL-BODY AND CHASSIS



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### LIGHTING RELAY, TAIL RELAY

Check continuity between the relay terminals.

① – ⑤ ..... No continuity

(When battery voltage is applied between ② and ④)

① - ⑤ ..... Continuity

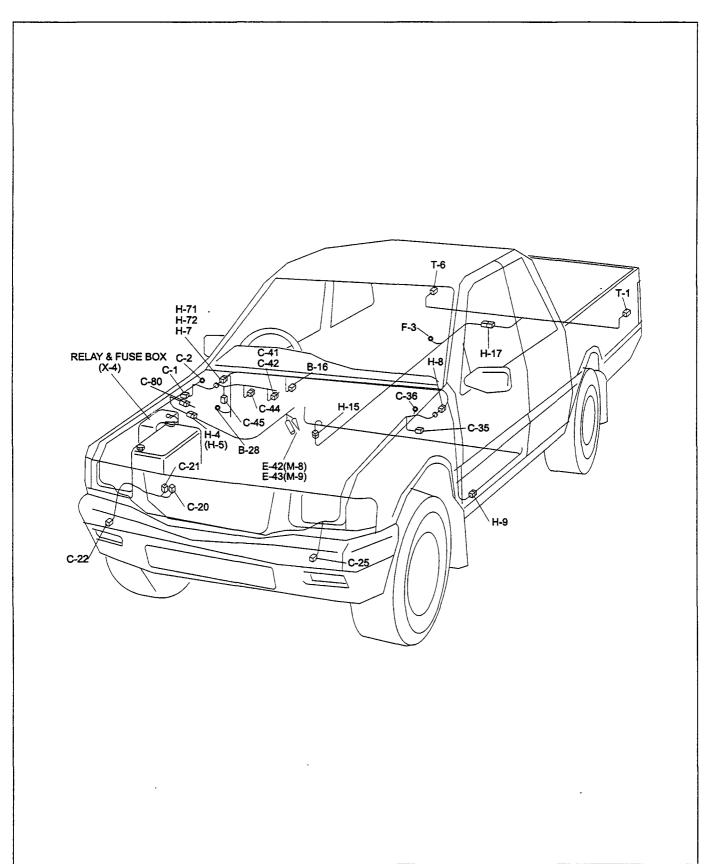
# ILLUMINATION CONTROLLER

**Controller Inspection** 

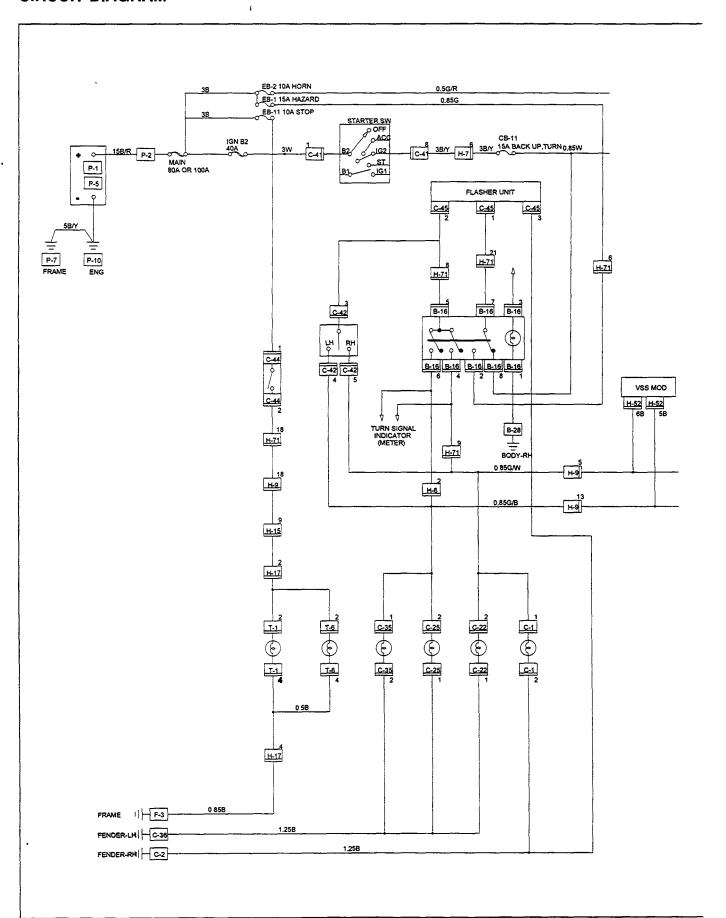
Check the illumination controller function.

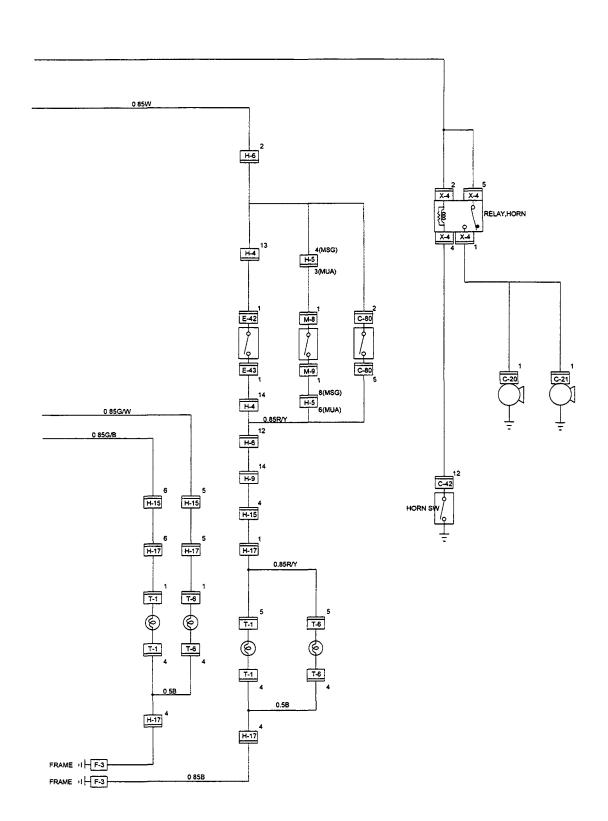
# HAZARD WARNING FLASHER, TURN SIGNAL LIGHT, BACK UP LIGHT, HORN & STOP LIGHT

**PART LOCATION** 



# **CIRCUIT DIAGRAM**

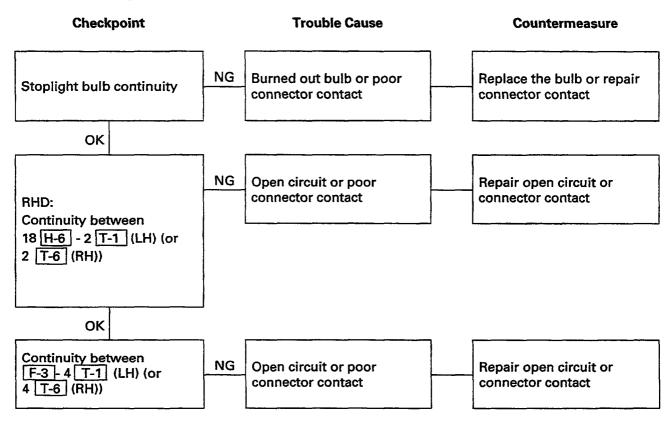




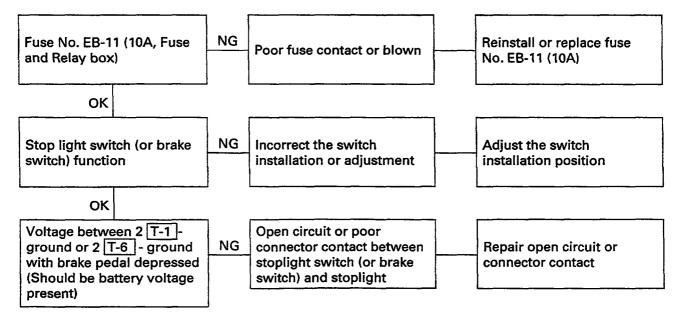
# TROUBLE SHOOTING

# STOPLIGHT AND HIGH MOUNTED STOPLIGHT

### 1. One side of stoplight does not light

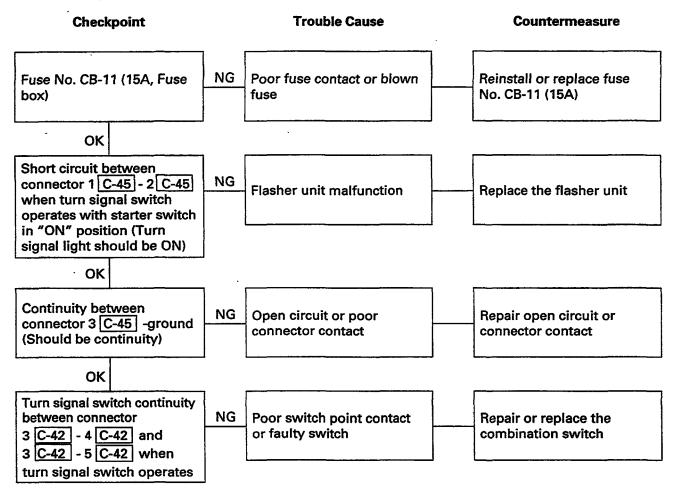


#### 2. Both sides of stoplight do not light

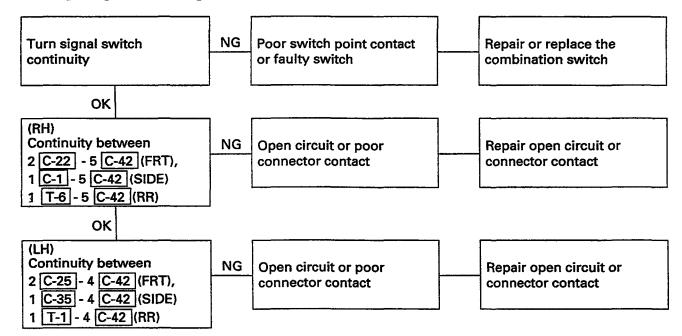


# **TURN SIGNAL LIGHT AND HAZARD WARNING LIGHT**

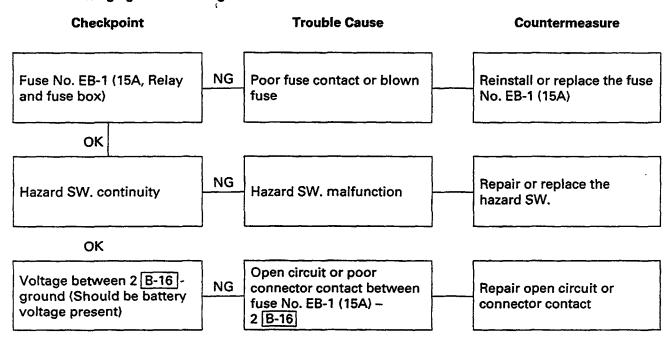
# 1. Turn signal light does not light on both sides (RH and LH)



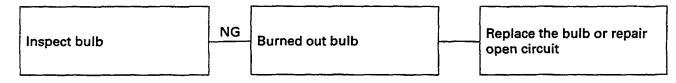
### 2. Turn signal light does not light on one side (RH or LH)



### 3. Hazard warning light does not light

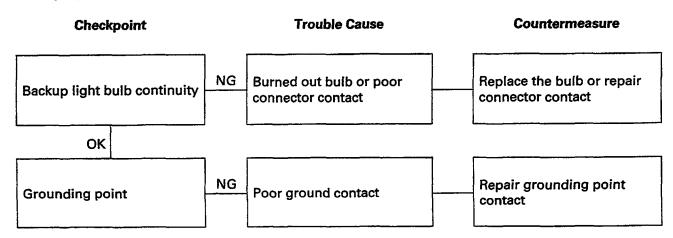


# 4. Flashing rate too fast (One side)

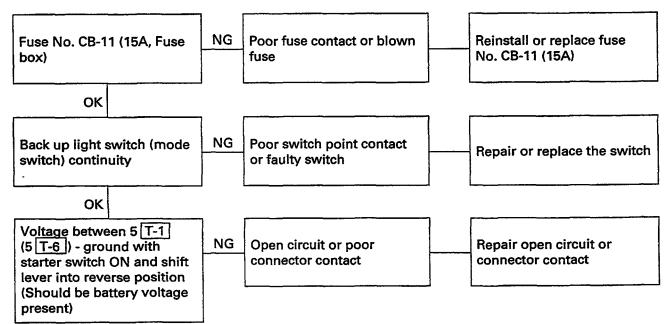


#### **BACKUP LIGHT**

#### 1. Backup light does not light on one side (RH or LH)

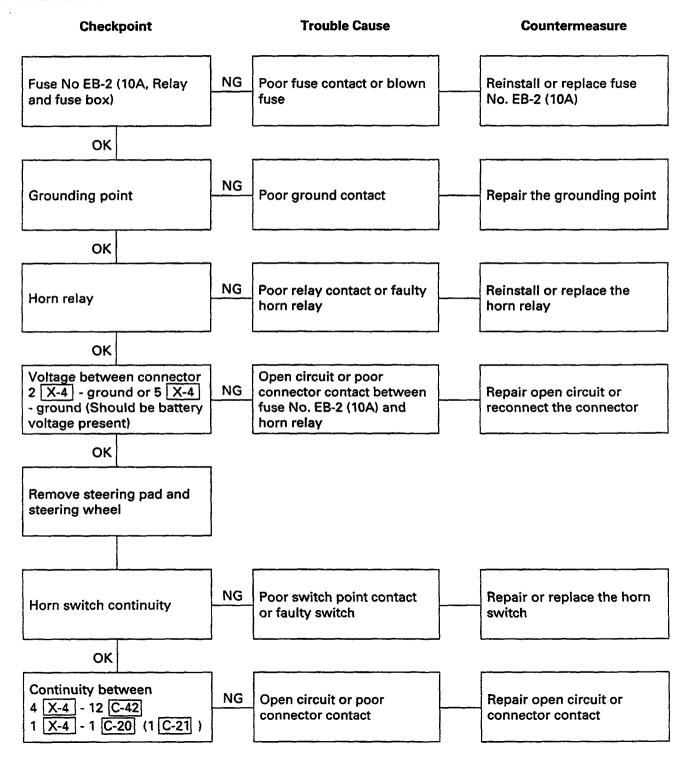


# 2. Backup light does not light on both sides

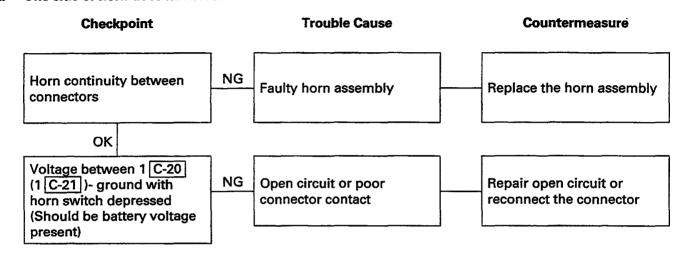


#### HORN

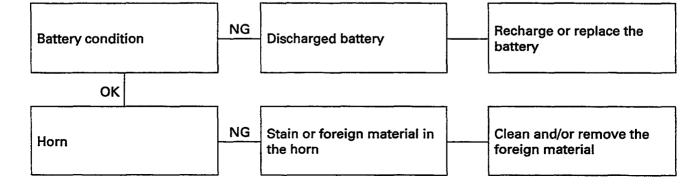
#### Both sides of horn do not sound



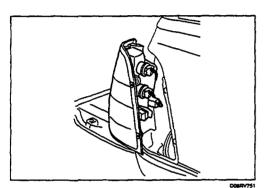
#### 2. One side of horn does not blow

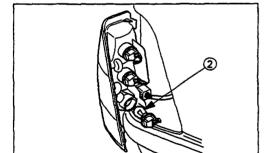


# 3. Insufficient horn volume



# REMOVAL AND INSTALLATION





# **REAR COMBINATION LIGHT**

# Stoplight



#### Removal

- 1. Open the rear gate.
- 2. Remove the screws of rear combination light.
- 3. Remove the rear combination light assembly.
- 4. Turn the bulb ② counterclockwise to remove it.

# ++

#### Installation

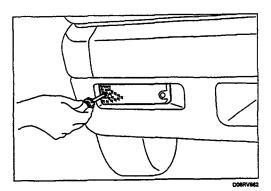
Follow the removal procedure in the reverse order to install the rear combination light.

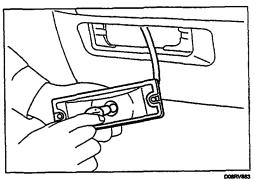


Pay close attention to the important points mentioned in the following paragraphs.

#### **Bulb**

Be absolutely sure that each bulb is correctly installed. This will prevent a poor contact and an open circuit.





# FRONT TURN LIGHT

- Removal
  - 1. Remove the front turn light lens.
  - 2. Pull the light housing free.

3. Push the bulb in and turn it counterclockwise to remove it from the light housing.



#### Installation

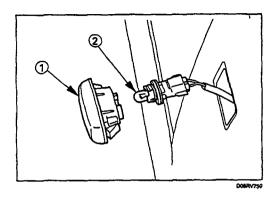
Follow the removal procedure in the reverse order to install the front turn light.



Pay close attention to the important points mentioned in the following paragraphs.

# Bulb

Be absolutely sure that the front turn light bulb is correctly installed.



#### SIDE TURN LIGHT

# **++**

#### Removal

- 1. Remove the lens 1.
  - Pull the light/bulb toward you while pushing the light housing in the rear direction of the vehicle to release its lock.
  - Remove the socket by turning it counterclockwise.
- 2. Pull the bulb ② to remove it.



#### Installation

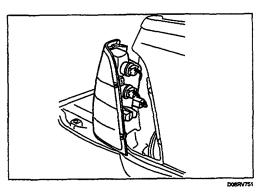
Follow the removal procedure in the reverse order to install the side turn light.

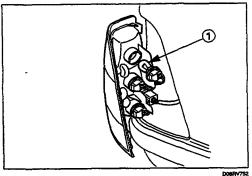


Pay close attention to the important points mentioned in the following paragraphs.

#### Bulb

Be absolutely sure that the side turn light bulb is correctly installed.





### **REAR COMBINATION LIGHT**

# Turn Signal Light



#### Removal

- 1. Open the rear gate.
- 2. Remove the screws.
- 3. Remove the rear combination light assembly.
- 4. Turn the bulb 1 counterclockwise to remove it.



#### Installation

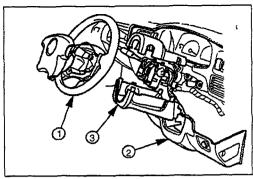
Follow the removal procedure in the reverse order to install the rear combination light.

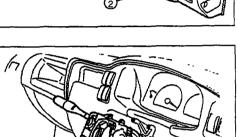


Pay close attention to the important points mentioned in the following paragraphs.

#### Bulb

Be absolutely sure that the rear combination light bulb is correctly installed.







#### Removal

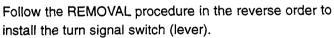


- Remote steering wheel 1.
   Refer to the "steering" Section of this Manual.
- 2. Remove the instruments panel lower cover 2.
- 3. Remove the steering column cover 3.

- 4. Disconnect the connector.
- 5. Remove the turn signal switch from the steering shaft.



# Installation

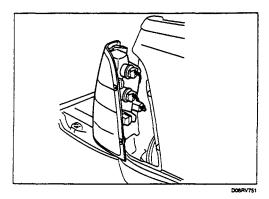


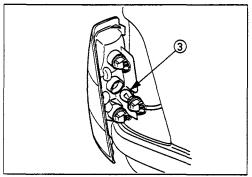


Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

Be absolutely sure that the turn signal switch connector is securely connected.





# **REAR COMBINATION LIGHT**

#### **Back Up Light**

# **++**

#### Removai

- 1. Open the rear gate.
- 2. Remove the screws.
- 3. Remove the rear combination light assembly.
- 4. Turn the bulb 3 counterclockwise to remove it.



#### Installation

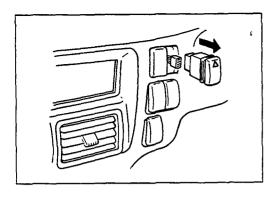
Follow the removal procedure in the reverse order to install the rear combination light.



Pay close attention to the important points mentioned in the following paragraphs.

#### Bulbs

Be absolutely sure that each bulb is correctly installed.





### HAZARD WARNING FLASHER SWITCH

#### Removal

- 1. Instrument Panel Cluster Assembly
  - Refer to Section 10 "body" for instrument panel cluster assembly REMOVAL steps.
- 2. Hazard Warning switch
  - Disconnect the switch connector.
  - To remove the switch, push the lock from the back side of the cluster assembly.



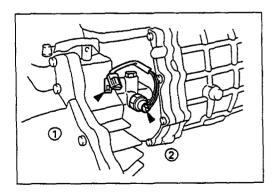
#### Installation

To install, follow the REMOVAL procedure in the reverse order.

#### Connector

Be absolutely sure that the hazard warning flasher switch connector is securely connected.

This will prevent a poor contact and an open circuit





# **BACK UP LIGHT SWITCH**

#### Removal

- 1. Disconnect the connector 1.
- 2. Remove the back up light switch from the transmission.



#### Installation

Follow the REMOVAL procedure in the reverse order to install the back up light switch.



Pay close attention to the important points mentioned in the following paragraphs.

### **Back up Light Switch Threads**

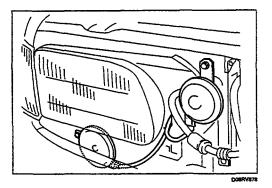


Apply liquid gasket to the threaded portion and install the back up light switch.

#### Connector

Be absolutely sure that the back up light connector is securely connected.

This will prevent a poor contact and an open circuit.



### **HORN**

# **(++)**

#### Removal

- Remove the radiator grille.
   Refer to the "HEADLIGHT" removal procedure.
- 2. Loosen the horn bolt.
- 3. Disconnect the horn connector.



#### Installation

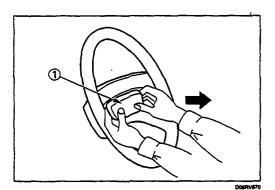
Follow the removal procedure in the reverse order to install the horn.



Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

Be absolutely sure that the horn connector is securely connected.

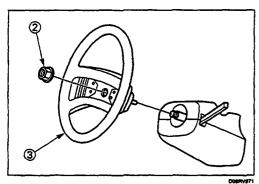


# **HORN SWITCH**

# **++**

#### Removai

1. Remove the horn pad ①.



- 2. Remove the steering wheel nut 2.
- 3. Remove the steering wheel 3.
- 4. Remove the horn switch.



#### Installation

Follow the removal procedure in the reverse order to install the horn switch.



Pay close attention to the important points mentioned in the following paragraphs.



# Steering Wheel Nut (2)

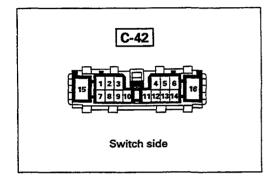
Tighten the nut to the specified torque.

Steering Wheel Nut Torque kg·m (lb·ft/N·m)

 $3.5 \pm 0.5 (25.3 \pm 3.6/34.3 \pm 4.9)$ 



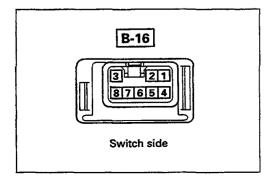
# **INSPECTION AND REPAIR**



# **TURN SIGNAL SWITCH**

**Lighting Switch Connections** 

Terminal No.		3	4	5
Turning direction	Left	0	0	
	$\leftrightarrow$	X-		-X
	Neutral			
	<b>\$</b>	x-	X	
,	Right	0		0

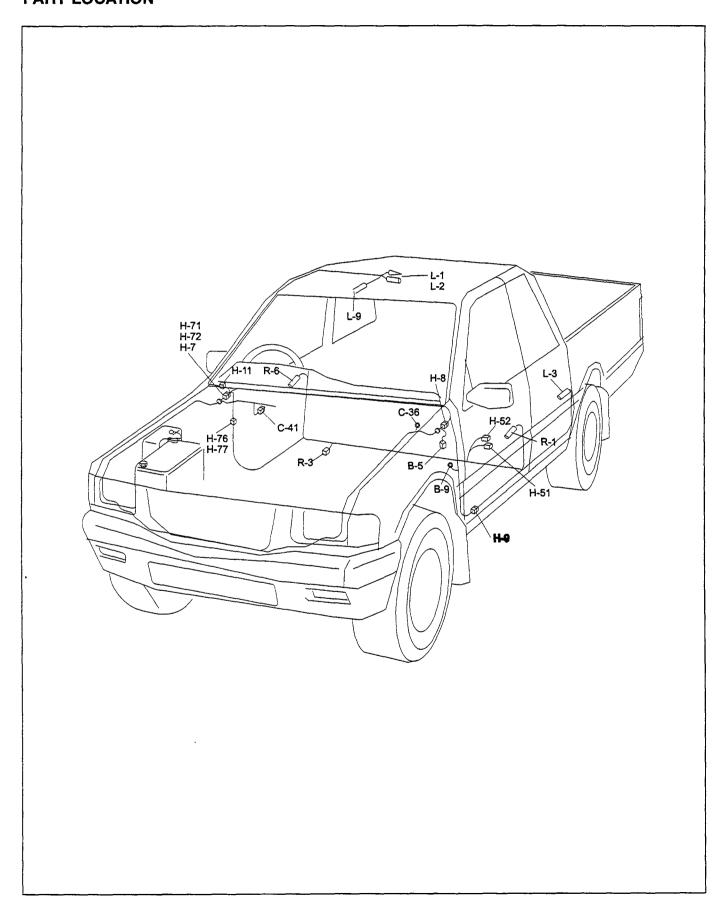


# HAZARD WARNING FLASHER SWITCH

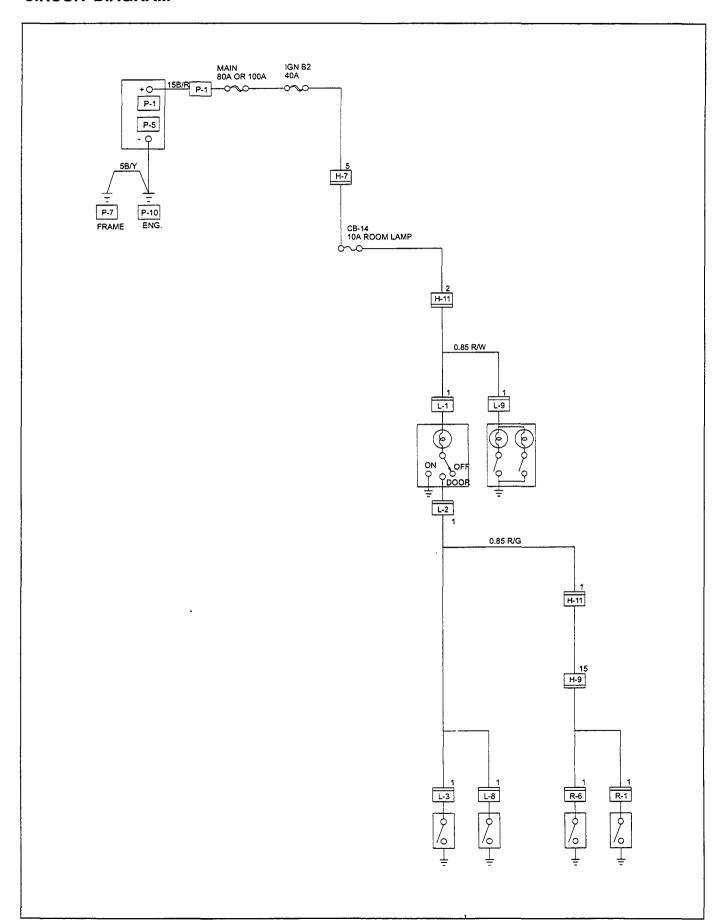
**Hazard Warning Flasher Switch Connections** 

Terminal No. position	4	5	6	7	8	2	1	3
ON	þ	þ	-0	0		P	4	يع ا
OFF				0	P		0	Ò

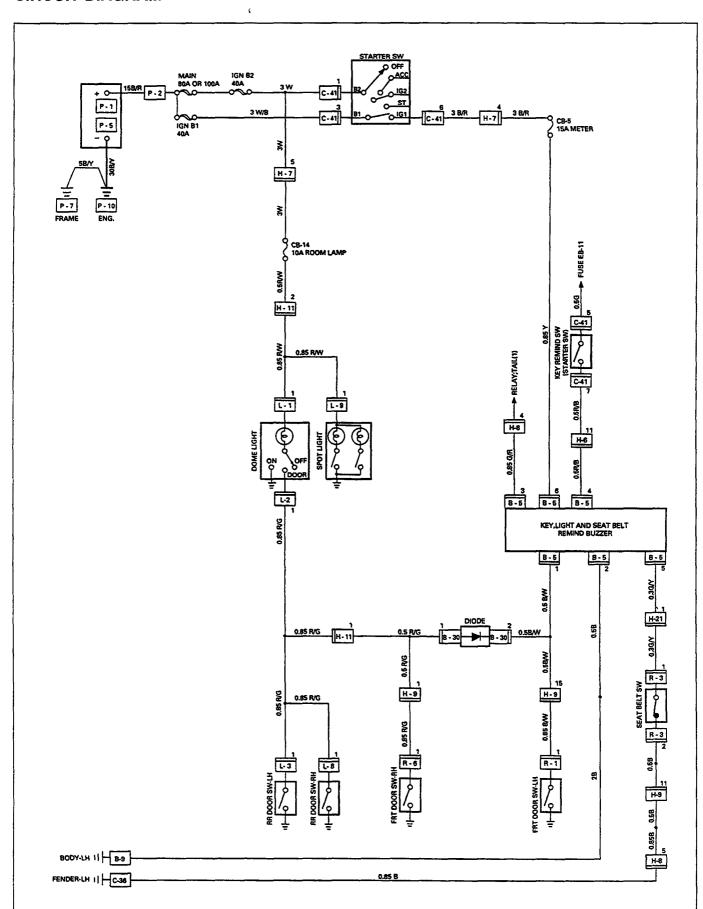
# DOME LIGHT, SPOT LIGHT, WARNING BUZZER PART LOCATION



# **CIRCUIT DIAGRAM**

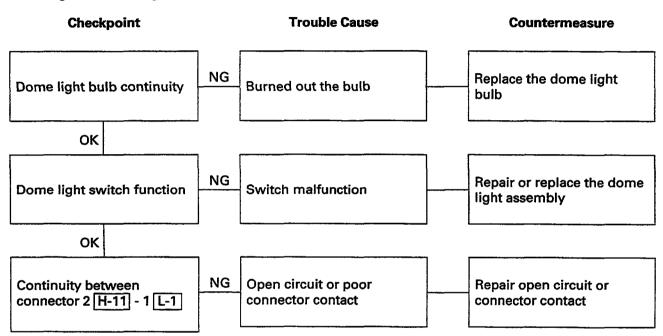


# **CIRCUIT DIAGRAM**

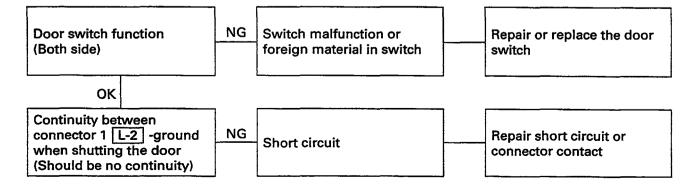


# **TROUBLE SHOOTING**

#### Dome light does not light

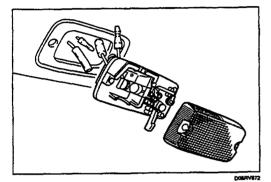


# 2. Dome light does not go out





# ++ REMOVAL AND INSTALLATION

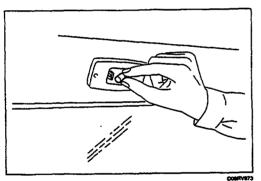


# **DOME LIGHT**

#### Removal

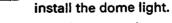
1. Remove the dome light cover free.

2. Pull the bulb to remove it.





Follow the removal procedure in the reverse order to

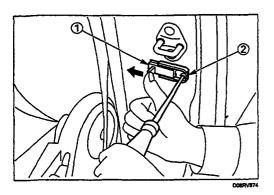




Pay close attention to the important points mentioned in the following paragraphs.

#### Bulb

Be absolutely sure that the dome light bulb is correctly installed.



#### DOOR SWITCH

#### Removal



- 1. Push the door switch sliding portion ① in the direction of the arrow in the illustration.
- 2. Loosen the screw 2.
- 3. Pull the switch free to remove it.
- 4. Disconnect the door switch connector.



#### Installation

Follow the removal procedure in the reverse order to install the spot light.

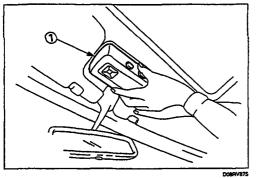


Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

Be absolutely sure that the door switch connector is securely connected.

This will prevent a poor contact and an open circuit.



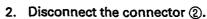
#### **SPOT LIGHT**

#### Removal

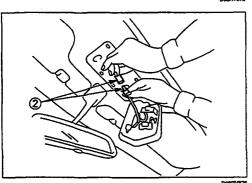


- 1. Grasp the spot light housing 1 with both hands.
  - Pull the housing straight down.

This will release the clip.



3. Push the bulb in and turn it counterclockwise to remove it.





#### Installation

Follow the REMOVAL procedure in the reverse order to install the spot light.



Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

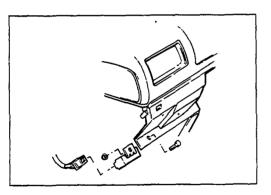
Be absolutely sure that the spot light connector is securely connected.

This will prevent a poor contact and an open circuit.

#### Bulb

Be absolutely sure that the spot light bulb is correctly installed.

This will prevent a poor contact and an open circuit.



Left hand dash panel 1 Warning buzzer



### WARNING BUZZER

# Removal

- 1. Dash Side Panel
- 2. Warning Buzzer
  - Disconnect the connector.
  - · Remove the screw



#### Installation

Follow the REMOVAL procedure in the reverse order to install the warning buzzer.



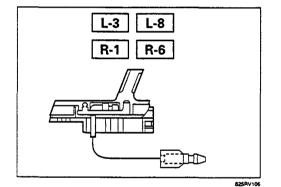
Pay close attention to the important points mentioned in the following paragraphs.

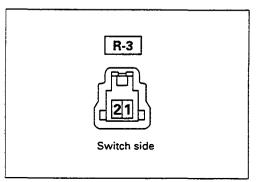
#### Connector

Be absolutely sure that the warning buzzer connector is securely connected.



# **INSPECTION AND REPAIR**





# **DOOR SWITCH**

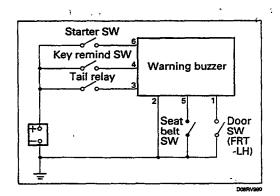
#### **Door Switch Connections**

Connector No.		L-3 L-8 R-1 R-6
position Terminal No.	1	Body Ground
PUSHED		
RELEASED	0	

# SEAT BELT SWITCH (SAUDI ARABIA, SOUTH AFRICA)

### **Seat Belt Switch Connections**

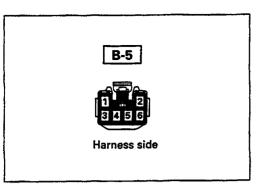
Connector No.	R-	3
SW position Terminal No.	1	2
ON (Belt tongue removed)	0-	<u> </u>
OFF (Belt tongue inserted)		



# **WARNING BUZZER (SOUTH AFRICA)**

1. Warning Buzzer Circuit

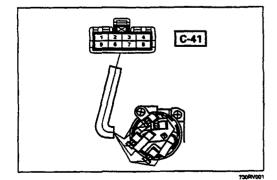
Warning function	Operational conditions
Fasten the seat belt	The buzzer sounds when the starter switch is turned on with the seat belt switch on (when the seat belt is not used).
Key left in starter switch	The buzzer sounds when both the key remind switch and the FRT door switch-LH are turned on. To stop the sound of the buzzer, turn on the starter switch.
Taillights left on	The buzzer sounds when the starter switch is turned from the "on" to "off" position while the taillights are on.



2. Warning Buzzer Harness Side Connector Circuit

Disconnect the warning buzzer connector and check continuity and voltage between the warning buzzer harness side connector terminals.

Terminal No.	Wire color	Connecting to	Check item	Connecting terminal	Check o	condition	Standard
_			0	5 C	Seat	Unfasten	Continuity
5	G/Y	Seat belt SW	Continuity	5-Ground	belt	Fasten	No continuity
3	G/R	Tail relay		3-Ground	Lighting SW "ON"		Approx. 12V
		Key remind SW	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4.6	Key	Insert	Approx. 12V
4	R/B	(Starter SW)	Voltage	4-Ground		Remove	0V
6	Y	Fuse CB-5	]	6-Ground	Starter SW "C	N"	Approx. 12V
- <del></del>	2001	Door SW		1 Conumed	ERT door I H	Open	Continuity
1	B/W	(FRT-LH)	Continuity	1-Ground	FRT door-LH	Close	No continuity
2	В	Ground	1	2-Ground			Continuity



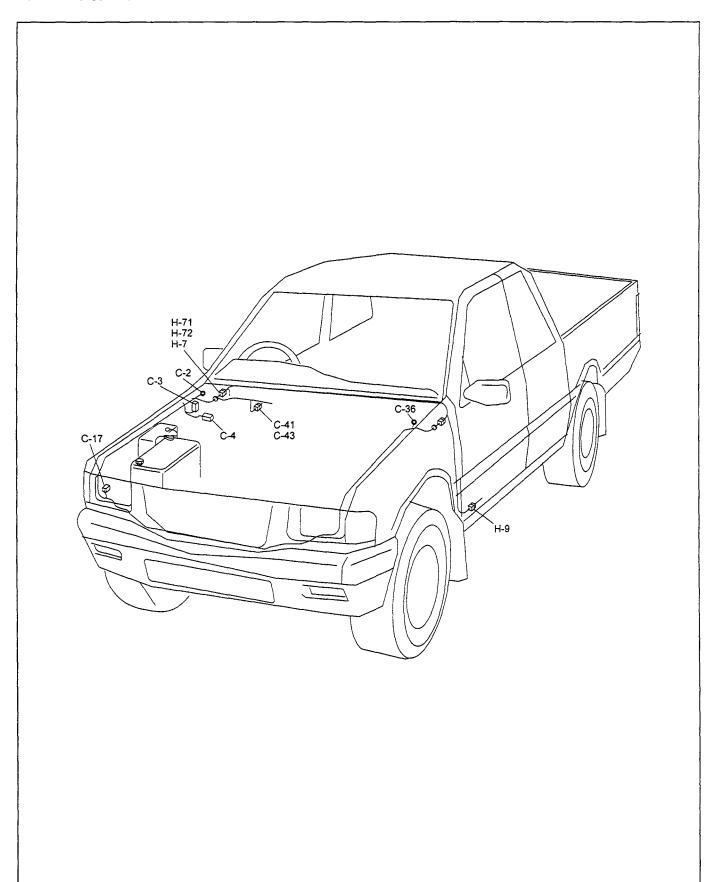
# **KEY REMIND SWITCH (STARTER SWITCH)**

# **Switch Connections**

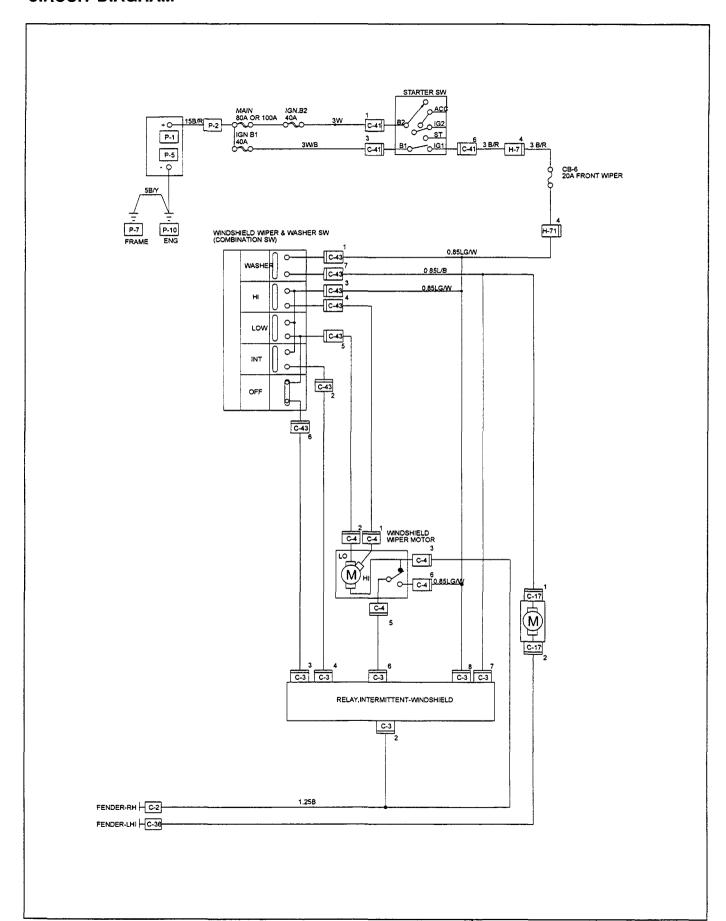
	Connector No.	C-	41
Starter switch key posi	Terminal No.	5	7
1.00%	Removed		
LOCK			1
OFF	]		
ACC	Inserted	O	0
ON			
START	7		

# WINDSHIELD WIPER AND WASHER

# **PART LOCATION**



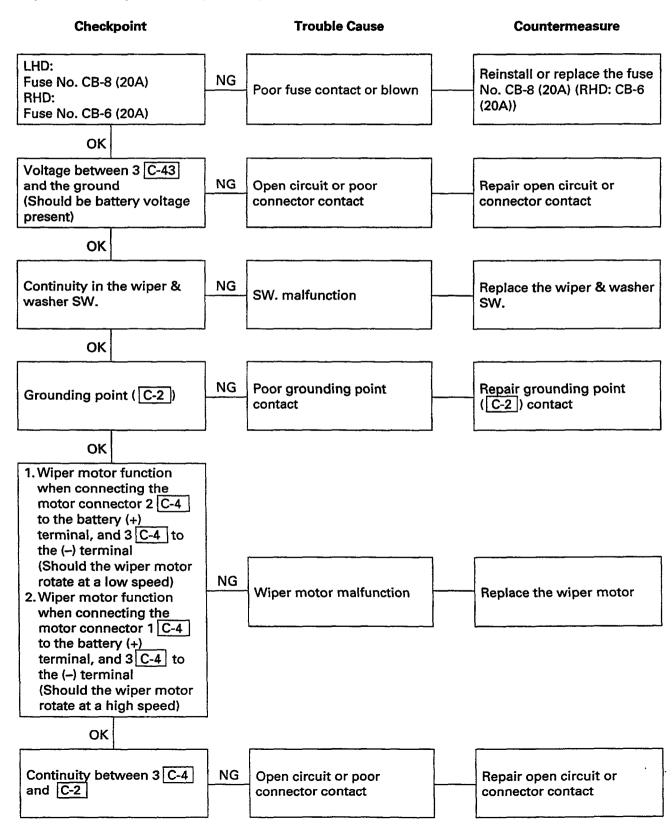
# **CIRCUIT DIAGRAM**



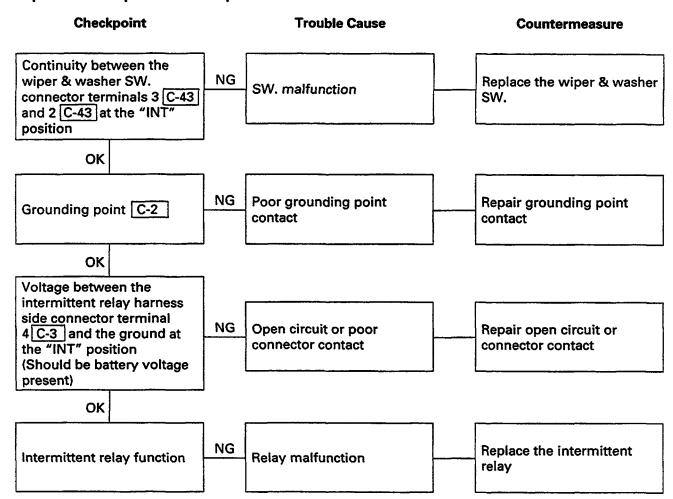
#### TROUBLE SHOOTING

#### WINDSHIELD WIPER

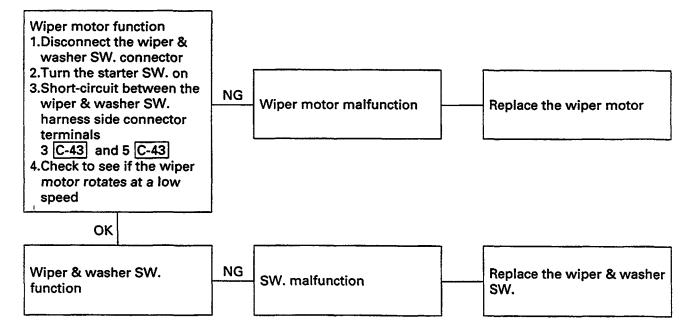
1. Wiper does not operate at any switch position



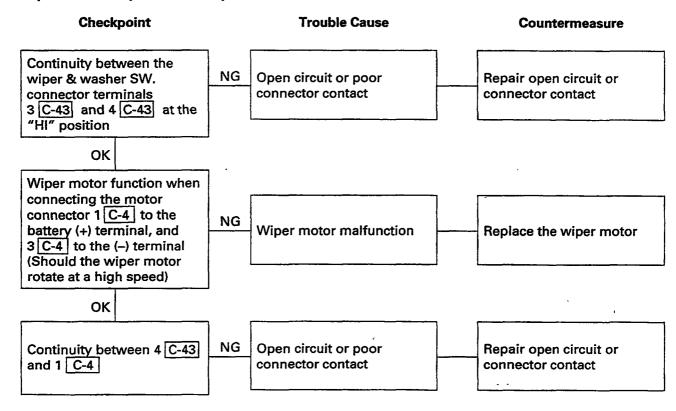
#### 2. Wiper does not operate at "INT" position



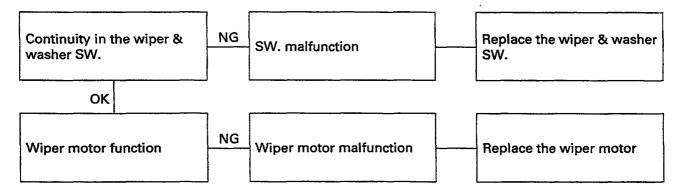
### 3. Wiper does not operate at "LO" position



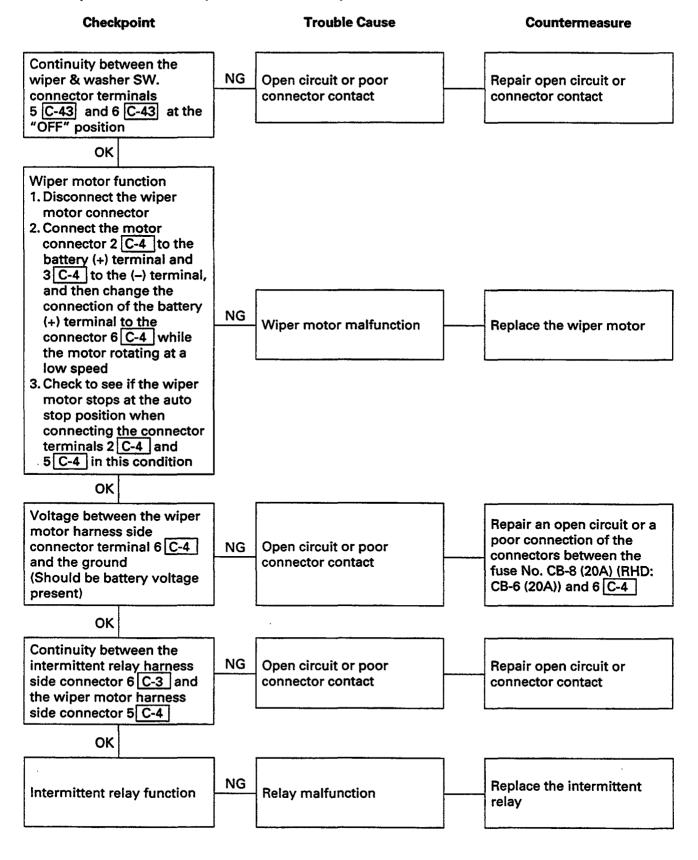
#### 4. Wiper does not operate at "HI" position



### 5. Rotation of the wiper motor does not stop

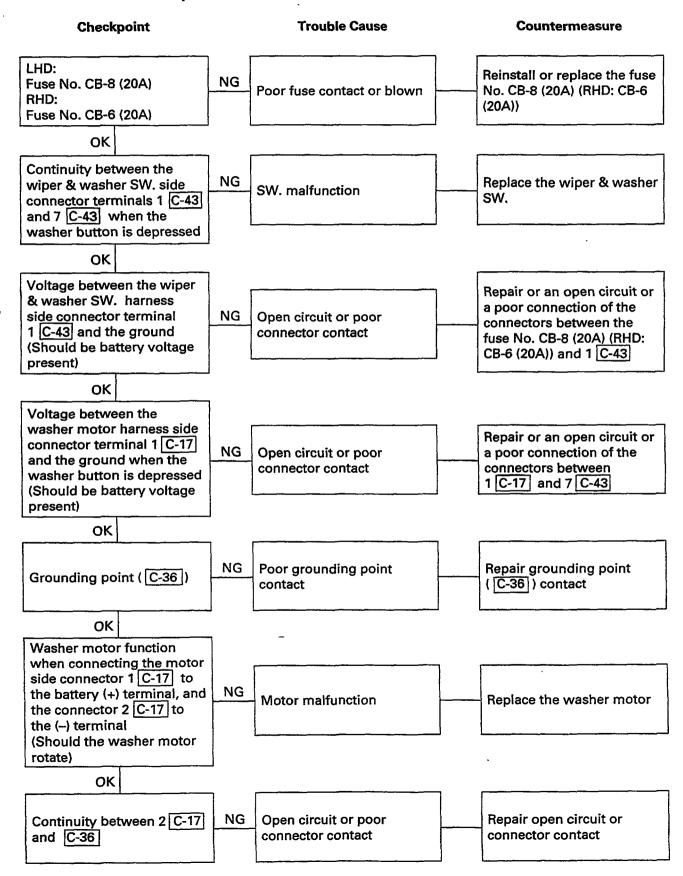


## 6. Auto-stop function of the wiper motor does not operate



#### WASHER

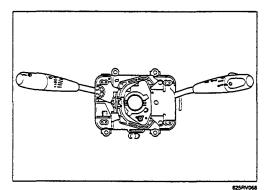
#### Washer motor does not operate







# **REMOVAL AND INSTALLATION**



### WIPER AND WASHER SWITCH

# **←→**

#### Removal

Refer to the removal steps of the LIGHTING SWITCH (COMBINATION SWITCH) in "LIGHTING" of this section.



#### Installation

Follow the removal procedure in the reverse order to install the wiper and washer switch.



Pay close attention to the important points mentioned in the following paragraphs.

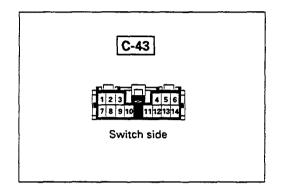
#### Connector

Be absolutely sure that the wiper and washer switch connector is securely connected.

This will prevent a poor contact and an open circuit.

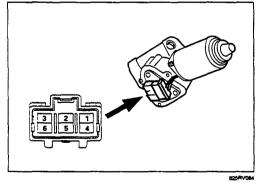
# 10

# **INSPECTION AND REPAIR**



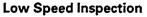
#### **Control Switch Connections**

Terminal No. SW position	6	3	5	4	2	1	7
Mist		0-	-0				
Off	0		P			_	
INT	0	0-	-0		9		
Lo		0	9				
Hi		0		0			
Wash						0	0

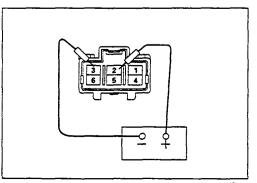


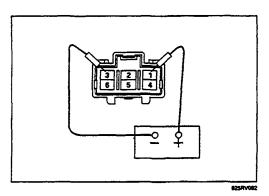


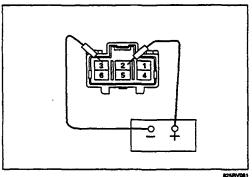
# Wiper Motor Inspection Connector

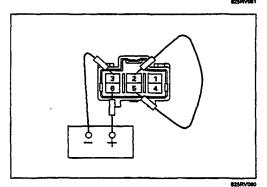


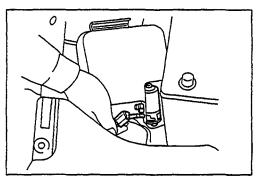
- Clamp the wiper motor in a vise.
   The moving parts must be clear of the vise.
- 2. Connect the connector terminals to the battery. Refer to the illustration.
- 3. Check the wiper motor low speed operation.











#### **High Speed Inspection**

- Clamp the wiper motor in a vise.
   The moving parts must be clear of the vise.
- 2. Connect the connector terminals to the battery. Refer to the illustration.
- 3. Check the wiper motor high speed operation.

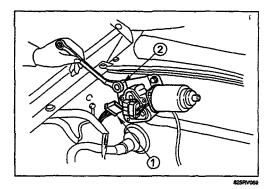
#### **Auto-Stop Inspection**

- Clamp the wiper motor in a vise.
   The moving parts must be clear of the vise.
- 2. Connect the connector terminals to the battery. Refer to the illustration.
- 3. Check the wiper motor low speed operation.
- 4. Disconnect the positive battery terminal. This will stop the motor.
- Connect the connector terminals No. 2 and No. 5 with a lead wire.
   Refer to the illustration.
- Reconnect the positive battery terminal to connector terminal No. 6.
   This will restart the motor.
   Refer to the illustration.
- 7. Check the auto-stop operation.



# **Washer Motor Inspection**

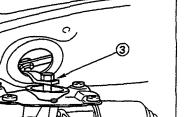
- 1. Fill the washer tank with washing solution.
- 2. Disconnect the motor connector.
- 3. Apply battery voltage to the washer motor connector.
- 4. Check the washer motor operation.



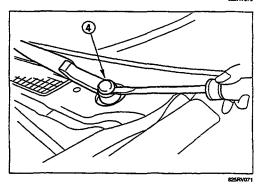
# **WIPER MOTOR AND LINKAGE** Removal



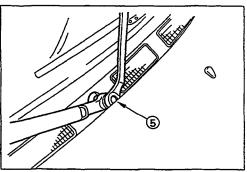
- 1. Disconnect the wiper motor connector (1).
- 2. Remove the wiper motor bracket screws ②.



3. Disconnect the wiper motor from the wiper linkage at the crank arm 3.



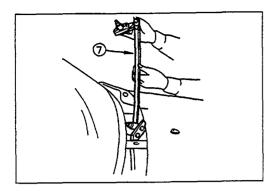
4. Disconnect the wiper arm nut cap 4.



- 5. Remove the wiper arm nut ⑤.
- 6. Remove the wiper arm with blade.



7. Remove the vent cowl cover ⑥.



8. Remove the wiper linkage (7) from the access hole.



#### Installation

Follow the REMOVAL procedure in the reverse order to install the wiper motor and linkage.



Pay close attention to the important points mentioned in the following paragraphs.

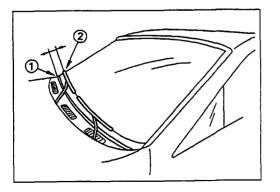
## Wiper Linkage

Take care not to scratch the painted surface of the body when installing the wiper linkage to the body.

In case crank arm of wiper motor is removed, confirm the position of auto Stop prior to reinstall the crank arm to the wiper motor.



Crank Arm Nut	Torque	kg-m(lb.ft/N-m)
	1.4 ± 0.2	10 ± 1.4/13.7 ± 2.0)



## **Wiper Blade Position**

Confirm the auto stop position of wiper motor prior to the installation of the wiper blade and arm.



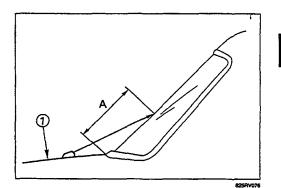
The distance between the vent cowl cover rubber seat 1 and the wiper blade edge (2) is 35 - 40 mm.

# Wiper Arm Nut

Tighten the wiper arm nut to the specified torque.



Wiper Arm Nut Torque kg-m (lb. ft/N-m)  $1.4 \pm 0.2 (10 \pm 1.4/13.7 \pm 2.0)$ 



### Windshield Washer Spray

Be sure that the engine hood ① is completely closed before checking the windshield washer spray adjustment.

Windshield Washer Spray Position

mm (in)

Α

Approximately 300 (11.8)

#### Connector

毴

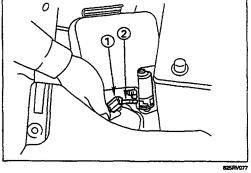
Be absolutely sure that the wiper motor connector is securely connected.

This will prevent a poor contact and an open circuit.

#### Note:

Windshield wiper arm and blade assembly configurations are different for the right-hand and left-hand side of the

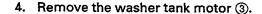
Be careful not to confuse the right-hand and left-hand side assemblies.

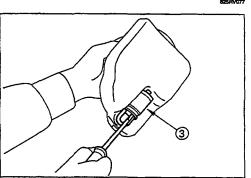


# **WASHER TANK MOTOR**

## Removai

- 1. Remove the washer tank bolts.
- 2. Disconnect the connector (1).
- 3. Disconnect the water hose ②.







#### Installation

Follow the removal procedure in the reverse constall the washer tank motor.



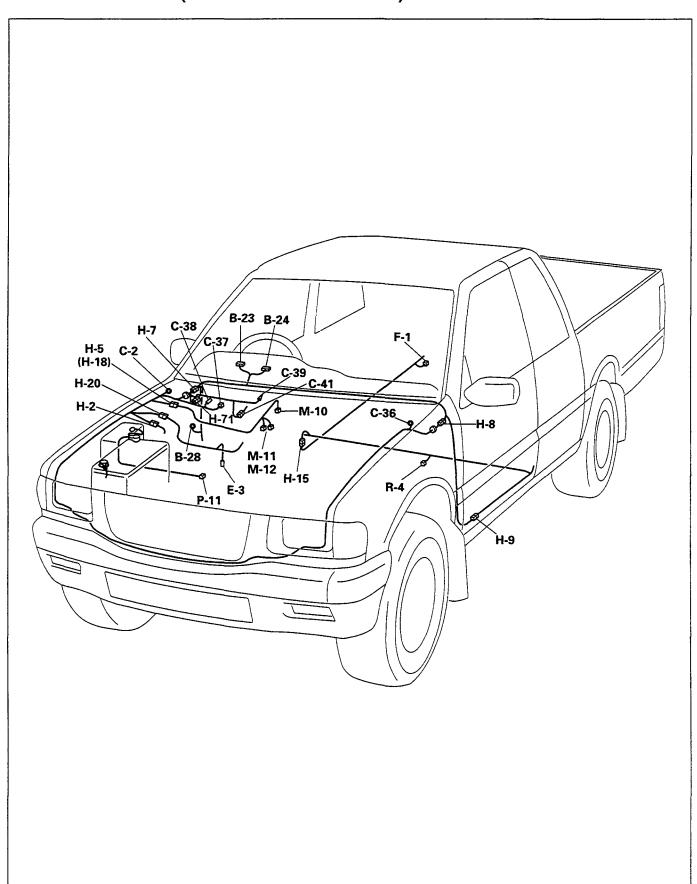
Pay close attention to the important points ment the following paragraphs.

#### Connector

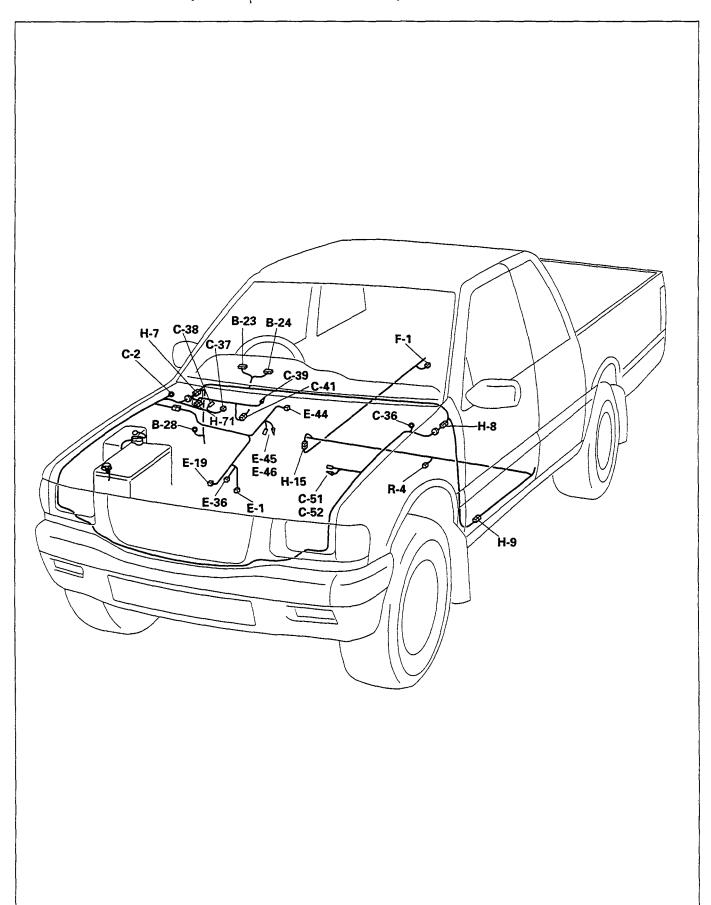
Be absolutely sure that the washer tank motor co is securely connected.

This will prevent a poor contact and an open circu

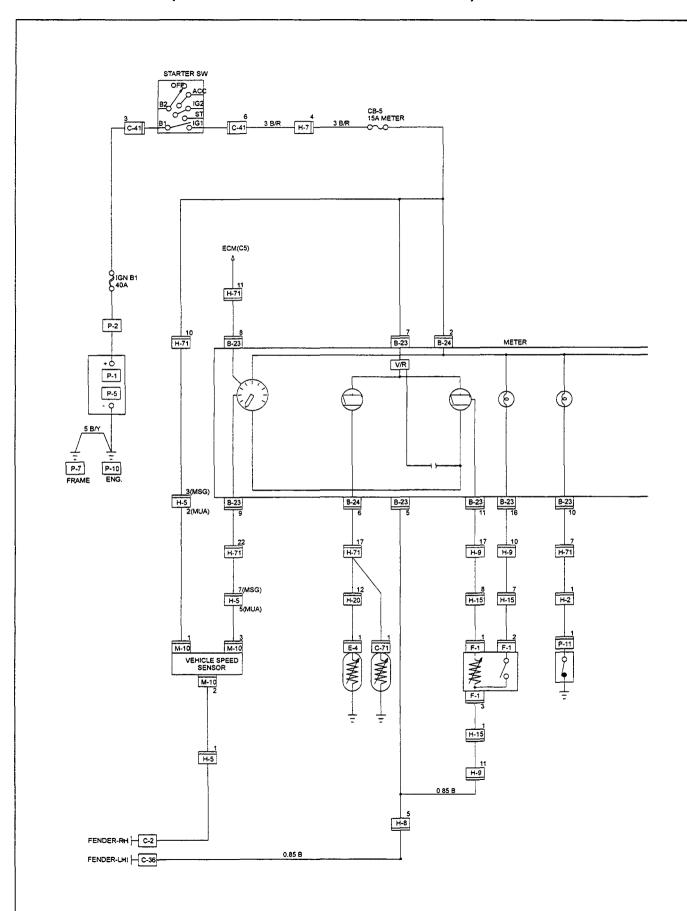
# METER, WARNING LIGHT AND INDICATER LIGHT PARTS LOCATION (PETROL ENGINE - RHD)

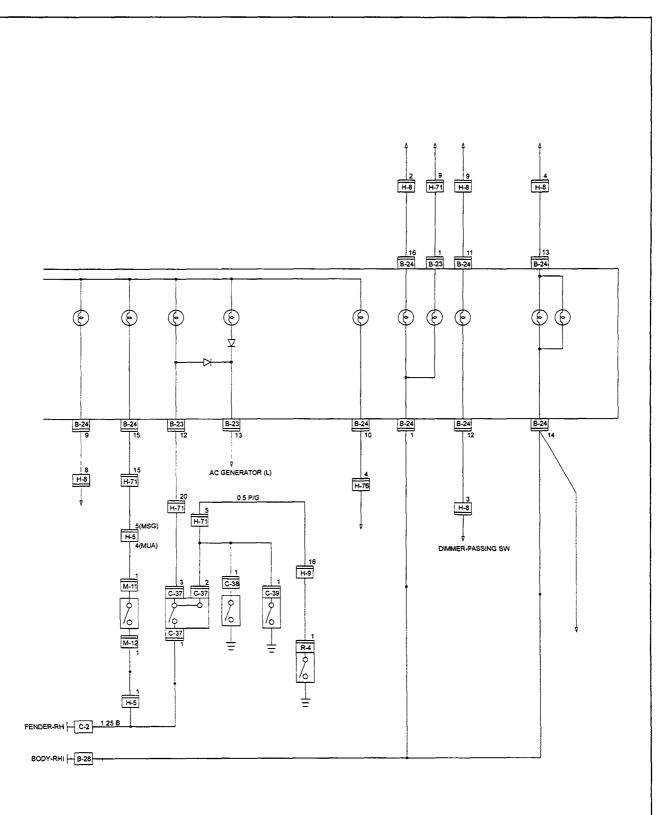


# PARTS LOCATION (DIESEL ENGINE - RHD)

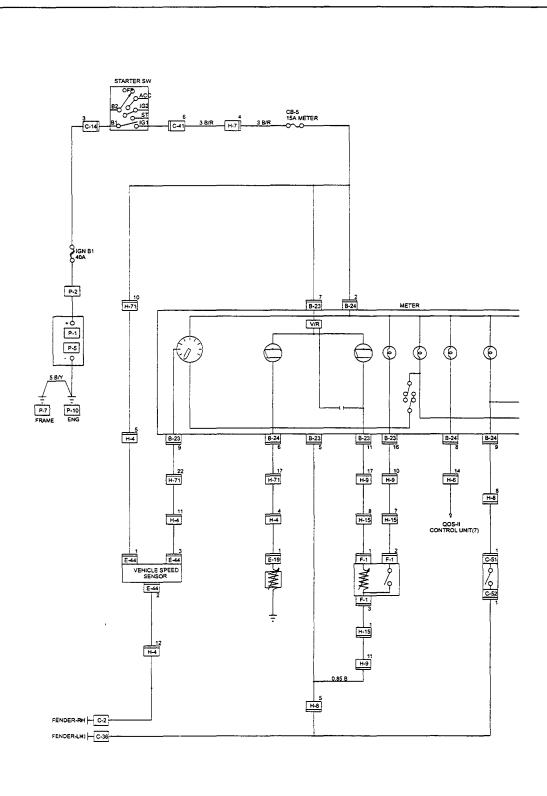


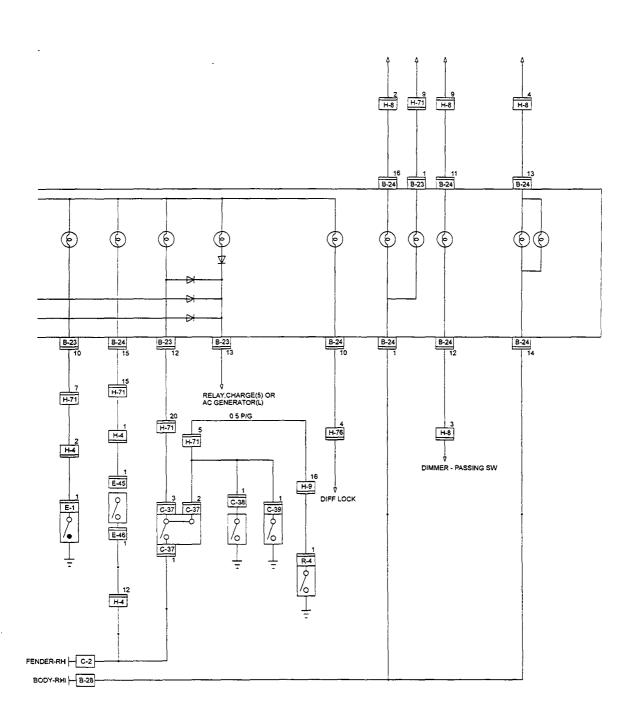
# **CIRCUIT DIAGRAM (W/O TACHOMETER - PETROL ENGINE)**





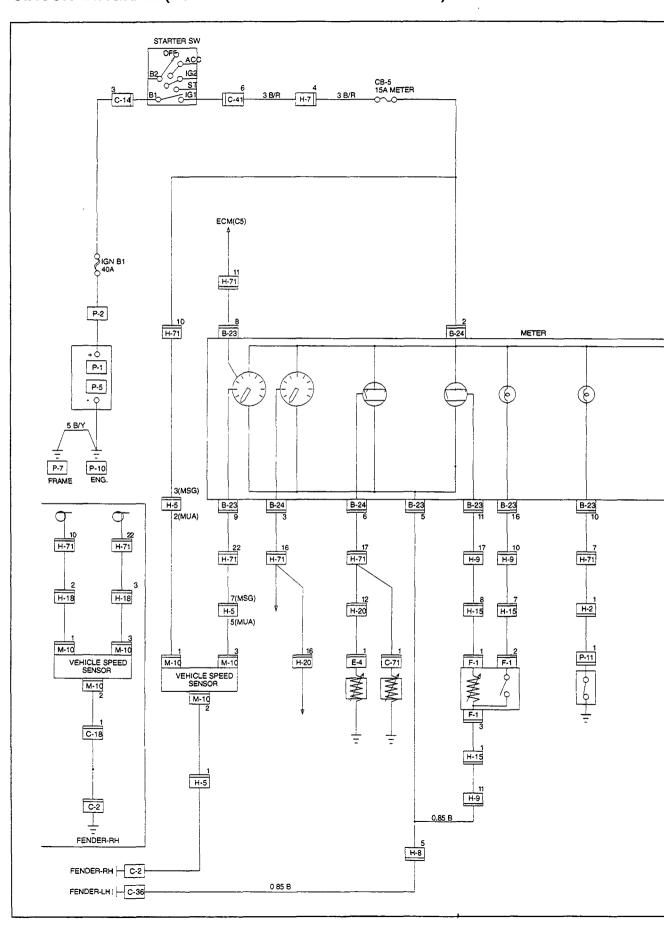
# CIRCUIT DIAGRAM (W/O TACHOMETER - DIESEL ENGINE)

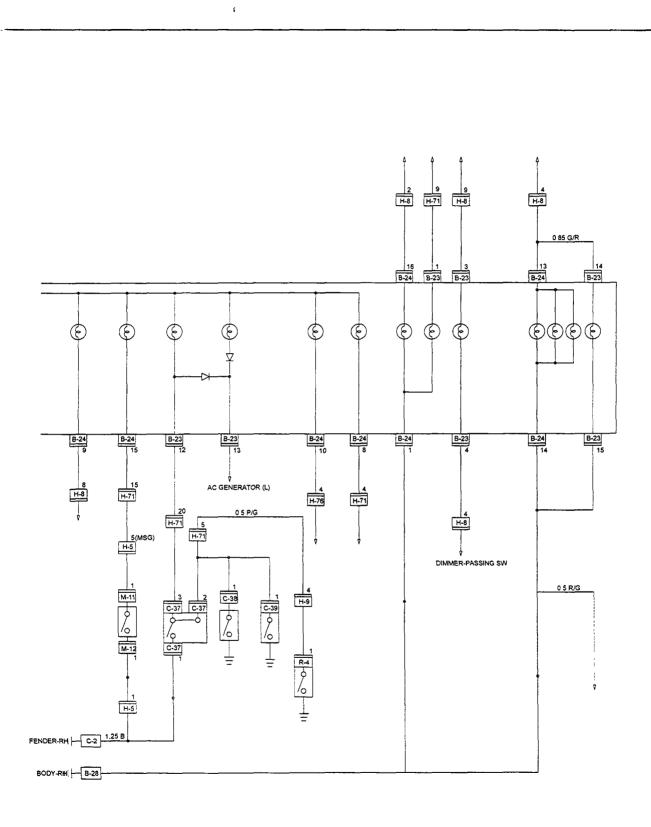




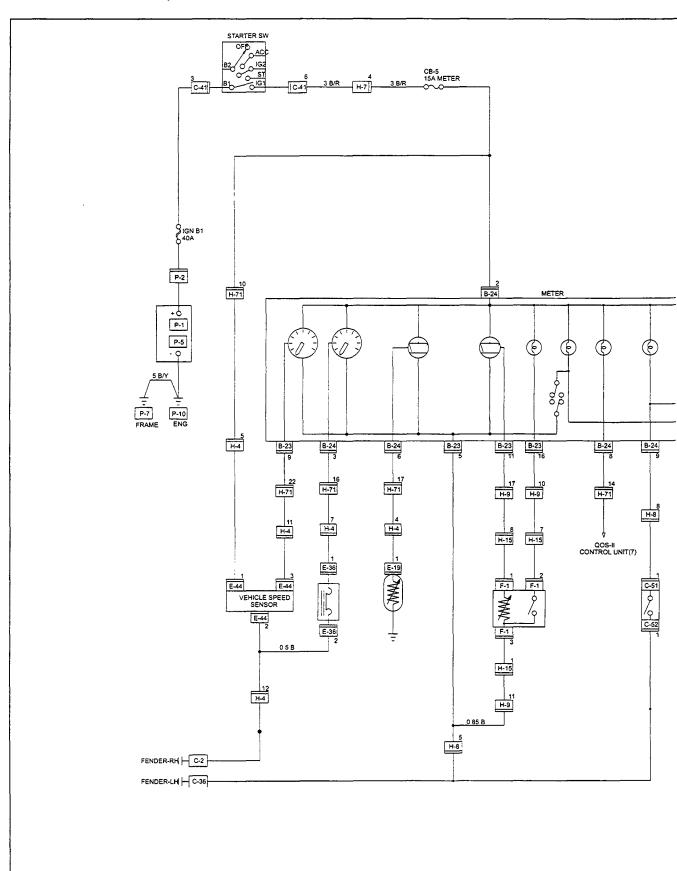
.

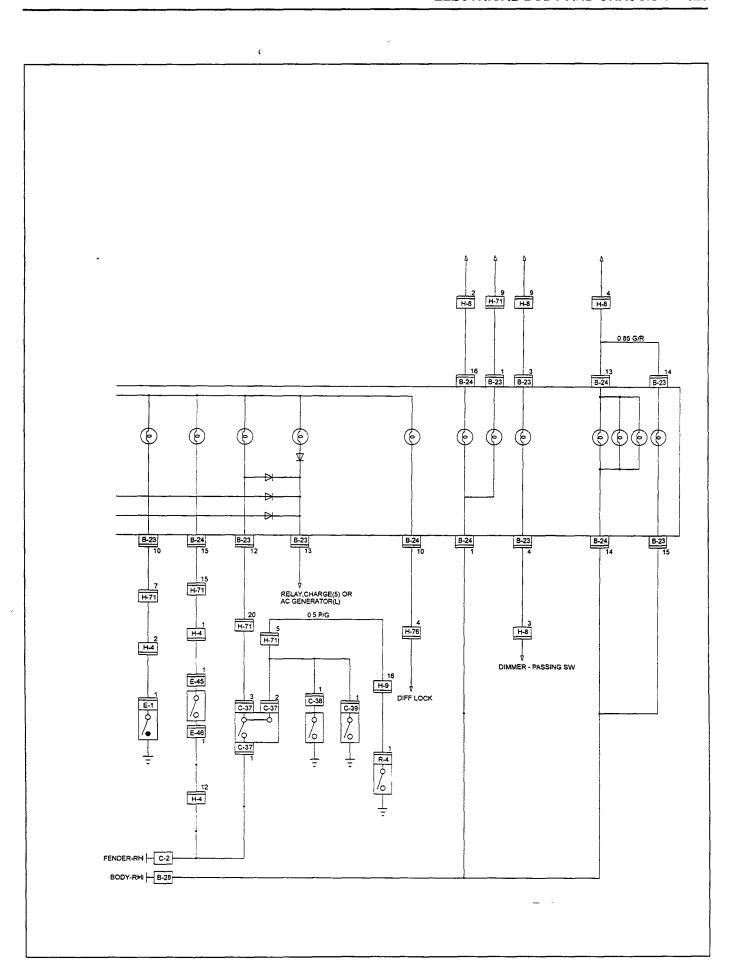
# **CIRCUIT DIAGRAM (W/TACHOMETER - DIESEL ENGINE)**





# **CIRCUIT DIAGRAM (W/TACHOMETER - DIESEL ENGINE)**

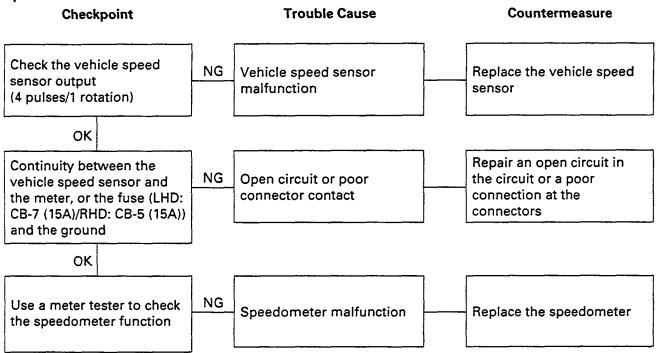




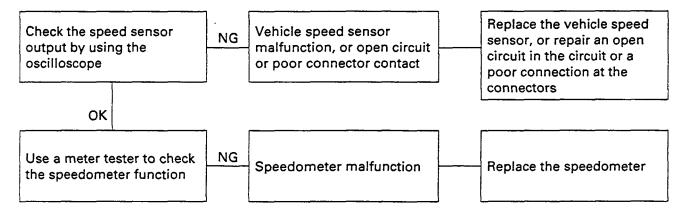
#### TROUBLE SHOOTING

#### **SPEEDOMETER**

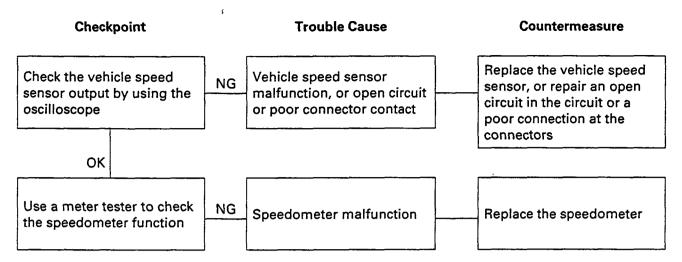
1. Speedometer and odometer do not function



2. Speedometer needle fluctuates (May be wide fluctuation)

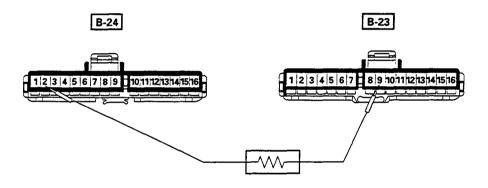


#### 3. Speedometer needle jumps erratically

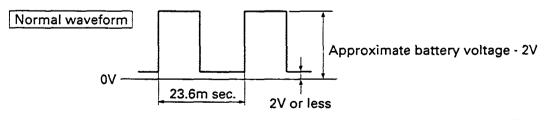


## Inspection of a waveform by oscilloscope

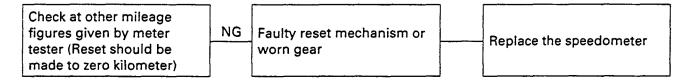
1. Connect a resistance of 1.3 to 5k ohm (1.4W or more) between the harness side connectors 2 B-24 and 9 B-23 of the meter.



- 2. Install a speedometer tester.
- 2. Turn on the starter SW.
- 3. Check the waveform at the time when the vehicle speed is at 60km/h.



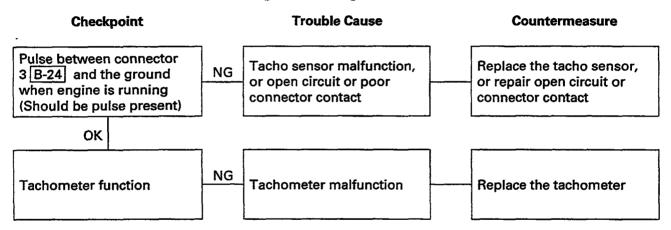
#### 4. Trip odometer does not reset



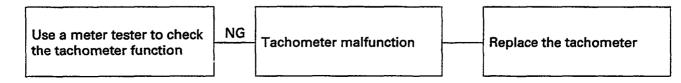
825FV1

#### **TACHOMETER**

1. Tachometer does not function when engine is running

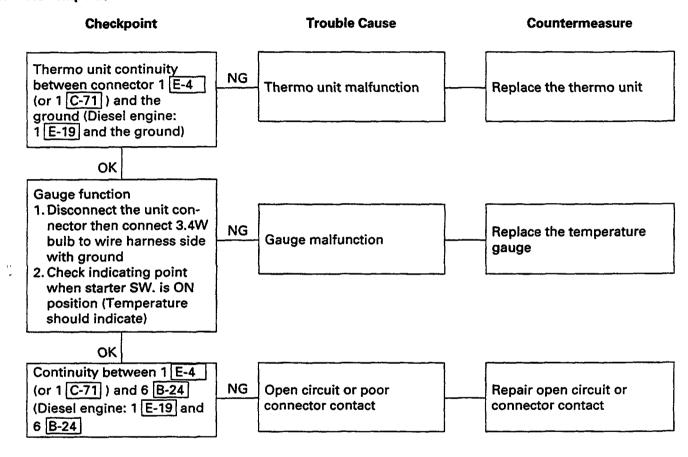


2. Meter needle fluctuates (May be wide fluctuation)

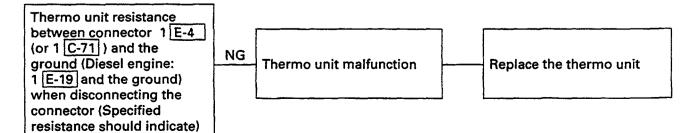


#### TEMPERATURE GAUGE AND THERMO UNIT

#### 1. No temperature indicates at all

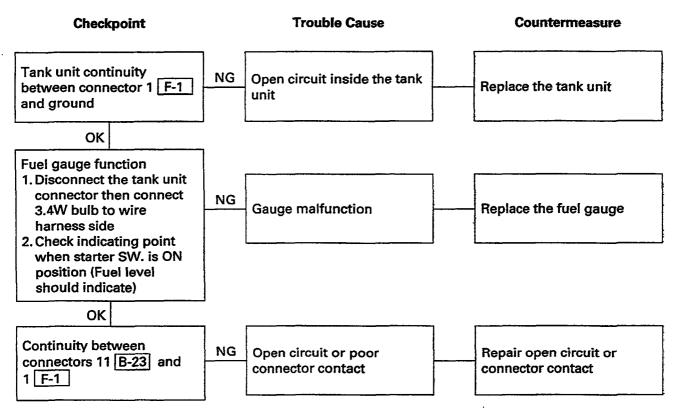


# 2. Temperature gauge incorrect readings in all ranges



#### **FUEL GAUGE AND FUEL TANK UNIT**

#### 1. No fuel level indicates at all

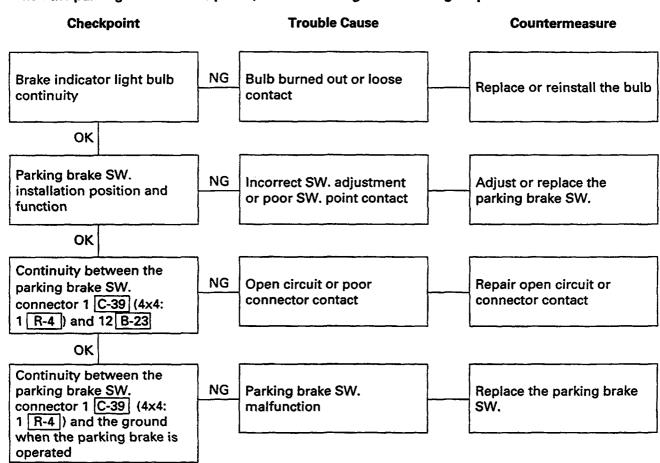


# 2. Fuel gauge gives incorrect readings in all ranges

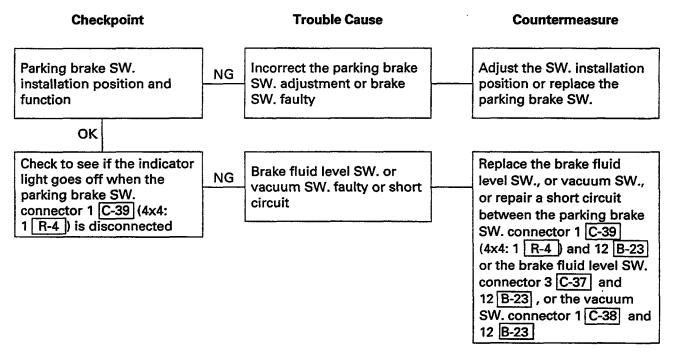
Tank unit resistance position with the float at checking points (Specified resistance should indicate)	NG	Tank unit malfunction		Replace the tank unit	· · · · · · · · · · · · · · · · · · ·
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#### WARNING AND INCIDATOR LIGHT

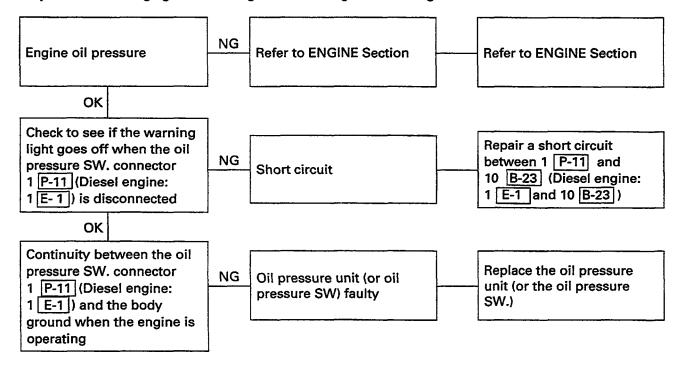
When the parking brake lever is pulled, the indicator light does not light up



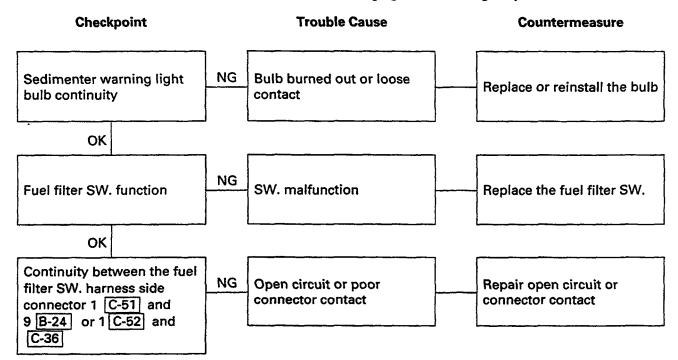
### 2. Even when the parking brake lever is pulled, the indicator light does not go off



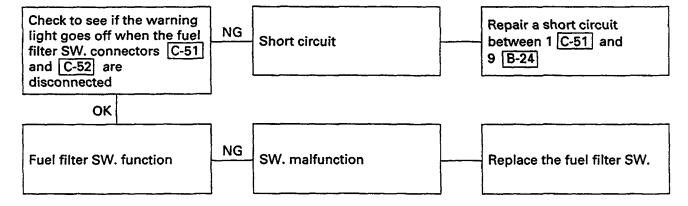
#### 3. Oil pressure warning light does not go off while engine is running



#### 4. Even when the fuel filter is filled with water, the warning light does not light up



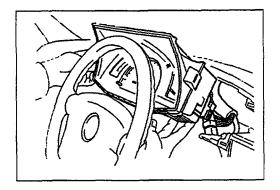
## 5. Even when the fuel filter is empty, the warning light does not go off







# REMOVAL AND INSTALLATION





#### METRE ASSEMBLY

#### Removal

- 1. Instrument Panel Driver Lower Cover
  - Refer to the REMOVAL steps of INSTRUMENT PANEL in Section 10 "CAB".
- 2. Lower Cluster Assembly
  - Refer to the REMOVAL steps of INSTRUMENT PANEL in Section 10 "CAB".
- 3. Instrument Panel Cluster Assembly
  - Refer to the REMOVAL steps of INSTRUMENT PANEL in Section 10 "CAB".
- 4. Metre Assembly
  - · Remove four screws of the metre assembly.
  - Disconnect the metre connectors.



#### Installation

Follow the REMOVAL procedure in the reverse order to install the metre.



Pay close attention to the important points mentioned in the following paragraphs.

#### Connector

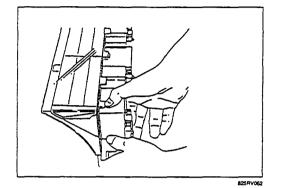
Be absolutely sure that the metre connectors are securely connected.

This will prevent a poor contact and an open circuit.

#### Wire Harness

Do not pinch the wire harness between the cluster and the meter hood during the meter assembly installation procedure.

Wire damage will result.



#### **METERS AND GAUGES**

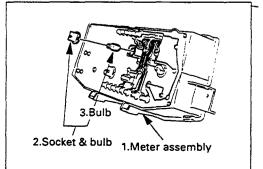
#### Removal

- 1. Meter Assembly
  - Refer to "METER ASSEMBLY" removal steps in this system.
- 2. Meter Glass
- 3. Meter Needless
  - Pull out the needles of speedometer and tachometer
- 4. Meter Board
  - · Loosen four fixing screws.
- 5. Meters and Gauges



#### Installation

To Install, follow the removal steps in the reverse order.



# WARNING LIGHT BULB, INDICATOR LIGHT BULB AND ILLUMINATION LIGHT BULB

# **+**+

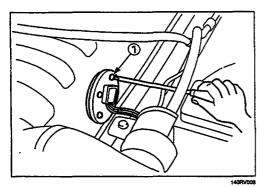
#### Removal

Turn the bulb socket counterclockwise and pull the bulb out.



#### Installation

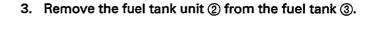
To Install, follow the removal steps in the reverse order.

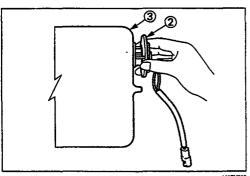


#### **FUEL TANK UNIT**

#### Removal

- 1. Disconnect the fuel tank unit connector.
- 2. Loosen the screws 1.







#### Installation

Follow the removal procedure in the reverse order to install the fuel tank unit.



Pay close attention to the important points mentioned in the following paragraphs.

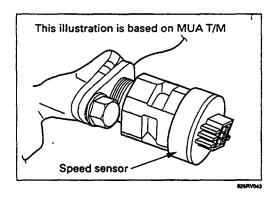
#### **Rubber Seal**

Be absolutely sure that the fuel tank unit rubber seal is correctly seated.

#### Connector

Be absolutely sure that the fuel tank unit connector is securely connected.

This will prevent a poor contact and an open circuit.



# VEHICLE SPEED SENSOR (INSTALLED ON THE TRANSMISSION)



#### Removal

- 1. Disconnect the connector.
- 2. Remove the vehicle speed sensor body by rotating it.



#### Installation

To Install, follow the removal steps in the reverse order, noting the following point.

Tighten the vehicle speed sensor to the specified torque.

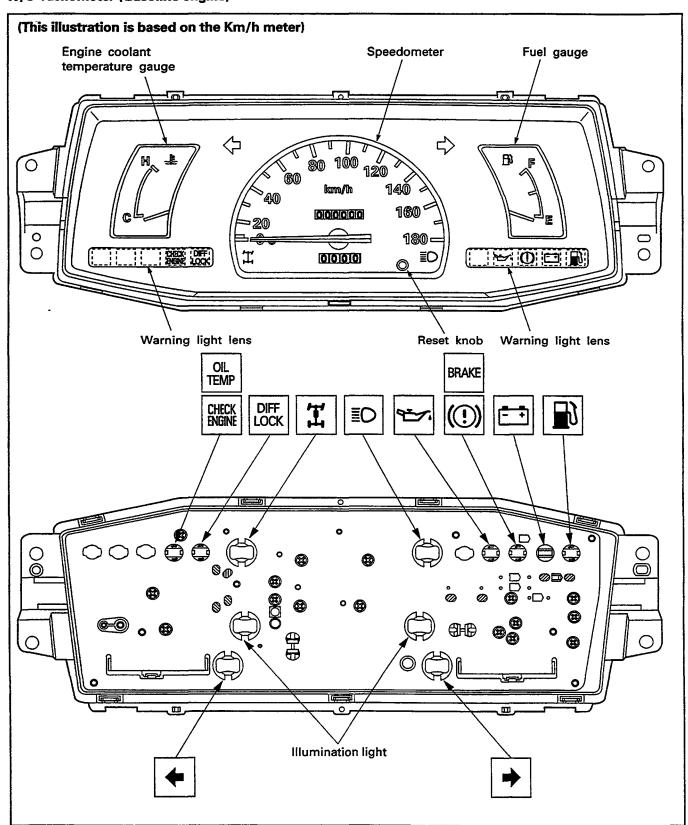


Vehicle Speed Sensor Tightening Torque kg·m (lb·ft/N·m)

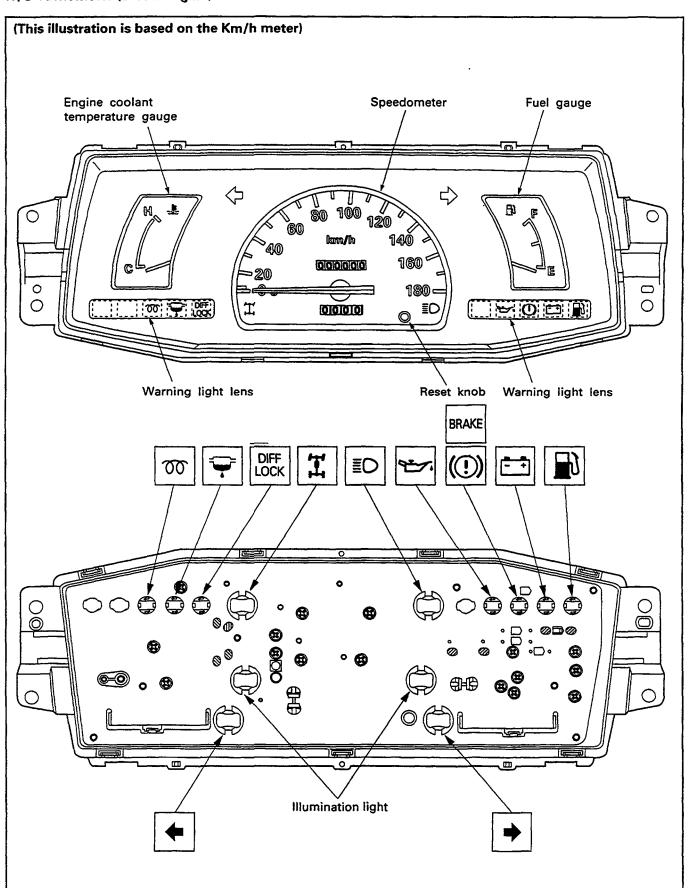
 $2.5 \pm 0.5 (18 \pm 3.6 / 25 \pm 4.9)$ 

# INSPECTION AND REPAIR

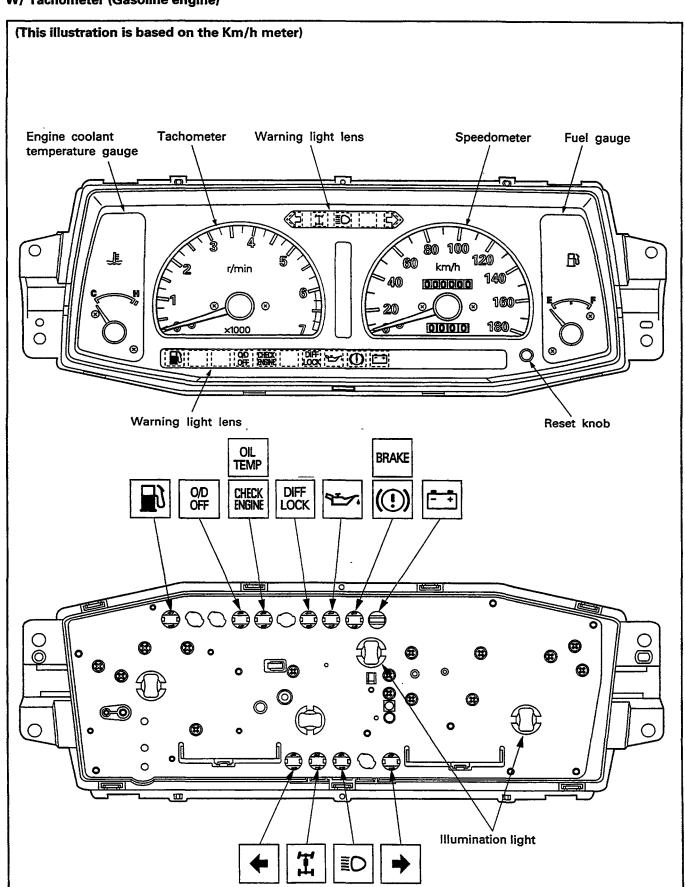
Warning, indicator and illumination light position W/O Tachometer (Gasoline engine)



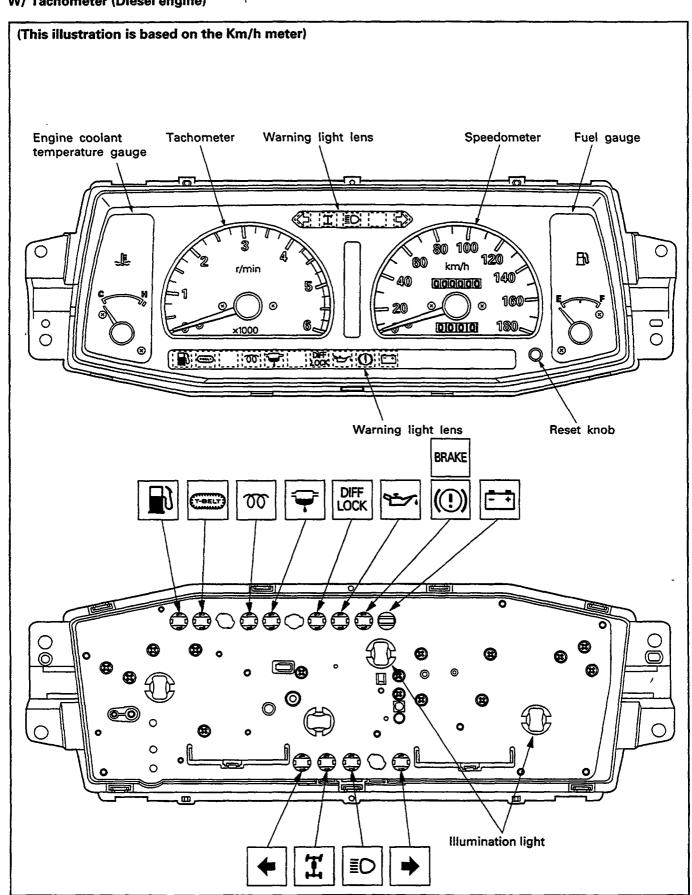
## W/O Tachometer (Diesel engine)



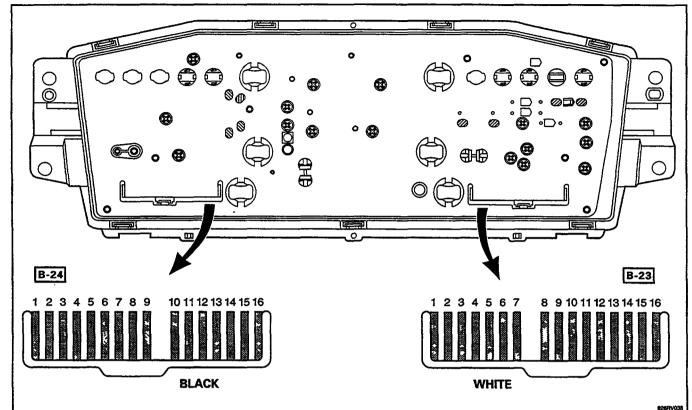
### W/ Tachometer (Gasoline engine)



# W/ Tachometer (Diesel engine)



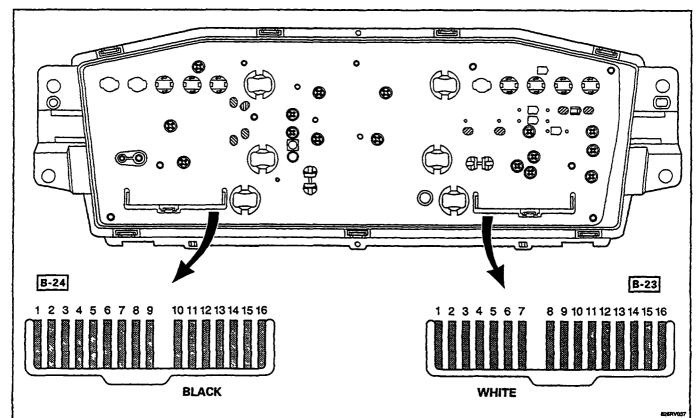
# Meter connector pin arrangement W/O Tachometer (Gasoline engine)



Connector No. Ter- minal No.	B-24	
1	Ground	
2	Ignition	
3	_	
4		
5	_	
6	Engine coolant temperature gauge	
7	<b>-</b>	
8	<del>-</del>	
9	Oil temp. warning light (Saudi Arabia only) Check engine warning light	
10	Seat belt warning light (Saudi Arabia only) Diff. lock indicator light (South Africa only)	
11	High-beam indicator light (+)	
12	High-beam indicator light (-)	
13	Illumination light (+)	
14	Illumination light (–)	
15	4WD indicator light	
16	Turn signal indicator light (left)	

	626FFV33		
Connector No. Ter- minal No.	B-23		
1	Turn signal indicator light (right)		
2	-		
3			
4	_		
5	Ground		
6	_		
7	Ignition		
8	Speedometer		
9	Speedometer		
10	Oil pressure warning light		
11	Fuel gauge		
12	Brake warning light		
13	Charge warning light		
14	_		
15	_		
16	Fuel warning light		

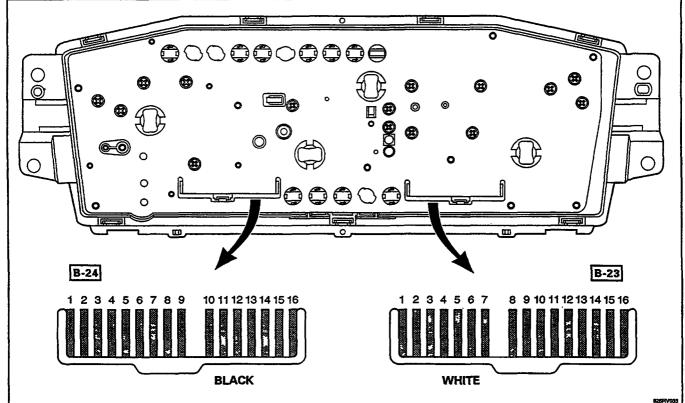
# Meter connector pin arrangement W/O Tachometer (Diesel engine)



Connector No. Ter- minal No.	B-24	
1	Ground	
2	Ignition	
3	_	
4		
5		
6	Engine coolant temperature gauge	
7		
8	Glow indicator light	
9	Sedimenter warning light	
10	Seat belt warning light (Saudi Arabia only) Diff. lock indicator light (South Africa only)	
11	High-beam indicator light (+)	
12	High-beam indicator light (-)	
. 13	Illumination light (+)	
14	Illumination light (-)	
15	4WD indicator light	
16	Turn signal indicator light (left)	

Connector No. Ter- minal No.	B-23
1	Turn signal indicator light (right)
2	_
3	_
4	
5	Ground
6	
7	Ignition
8	Speedometer
9	Speedometer
10	Oil pressure warning light
11	Fuel gauge
12	Brake warning light
13	Charge warning light
14	_
15	_
16	Fuel warning light

# Meter connector pin arrangement W/ Tachometer (Gasoline engine)

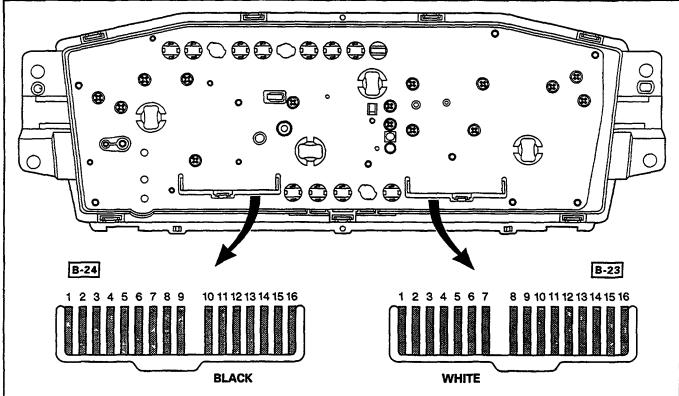


Connector No. Ter- minal No.	B-24
1	Ground
2	Ignition
3	Tachometer
4	
5	
6	Engine coolant temperature gauge
7	
8	O/D off indicator light (Australia: A/T)
9	Oil temp. warning light (Saudi Arabia only) Check engine warning light
10	Seat belt warning light (Saudi Arabia only) Diff. lock indicator light (South Africa only)
11	<del></del>
12	
13	Illumination light (+)
14	Illumination light (–)
15	4WD indicator light
16	Turn signal indicator light (left)

	825FV033
Connector No. Ter- minal No.	B-23
1	Turn signal indicator light (right)
2	
3	High-beam indicator light (+)
4	High-beam indicator light (-)
5	Ground
6	
7	
8	Speedometer
9	Speedometer
10	Oil pressure warning light
11	Fuel gauge
12	Brake warning light
13	Charge warning light
14	Illumination light (+)
15	Illumination light (-)
16	Fuel warning light

# Meter connector pin arrangement W/ Tachometer (Diesel engine)

Connector



Ter- No.	B-24	
minal No.		
1	Ground	
2	Ignition	
3	Tachometer	
4	_	
5		
6	Engine coolant temperature gauge	
7	_	
8	Glow indicator light	
9	Sedimenter warning light	
10	Seat belt warning light (Saudi Arabia only) Diff. lock indicator light (South Africa only)	
11	<del></del>	
12		
13	Illumination light (+)	
14	Illumination light (-)	
15	4WD indicator light	
16	Turn signal indicator light (left)	

B-23
Turn signal indicator light (right)
<del>-</del>
High-beam indicator light (+)
High-beam indicator light (-)
Ground
_
<u> </u>
Speedometer
Speedometer
Oil pressure warning light
Fuel gauge
Brake warning light
Charge warning light
Illumination light (+)
Illumination light (-)
Fuel warning light



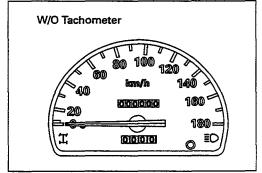
#### SPEEDOMETER AND TACHOMETER

**Speedometer On-Vehicle Inspection** 



Check the speedometer accuracy with a speedometer tester.

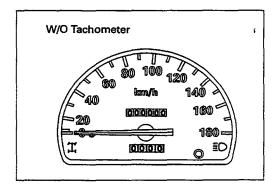
Carefully follow the tester manufacturer's instructions.

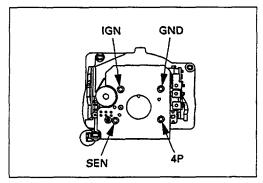


# W/Tachometer 80 100 80 100 120 40 000000 140 20 9 9 160 0101010 180

km/h meter (South Africa)

Indication	Permissible Range
20	20-25.6
40	40-45.6
60	60-65.6
80	80-85.6
100	99.5-105.9
120	119.5-125.9
140	139.5-145.9
160	159.1-166.3





#### km/h meter (South Africa)

		_
Indication	Permissible Range	
20	20-25	
40	40-45	
60	60-65	
80	80-85	
100	99.5-105.6	
120	119.5-125.6	
140	139.5-145.6	
160	159.1-166	



## **Speedometer Off-Vehicle Inspection**

Remove the speedometer from the metre assembly and measure the resistance and the current consumption between each terminal.

Speedometer Resistance

Terminal terminal symbol	Red (+)	Black (-)	Black (-)	Red (+)
	IGN	GND	IGN	GND
IGN - GND	∞		30.6 - 37.4K	
	SEN	GND	SEN	GND
SEN - GND	28.8 - 35.2K		∞	
	4P	GND	4P	GND
4P - GND	13.5 - 16.5K		۰	•

**Note:** Use the analog type circuit tester (ranges: x 1k).

# Speedometer Current Consumption

Terminal Symbol	Current consumption	Remarks
IGN - GND (+) (-)	85 ± 15 mA (when 12 ± 1V applied)	No signal input

#### Note:

- 1. Use the analog type circuit tester.
- 2. Since the current consumption fluctuates when the source voltage varies, check to be sure that the voltage applied is  $12V \pm 1V$ .



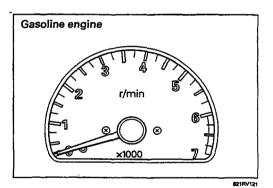
#### **Tachometer On-Vehicle Inspection**

- 1. Attach a tune-up tester to the engine.
- 2. Start the engine.



- Compare the tachometer reading and the tester reading.
  - If the tachometer indication is outside the permissible range, the tachometer must be replaced.
- 4. Gradually increase and decrease the engine speed.

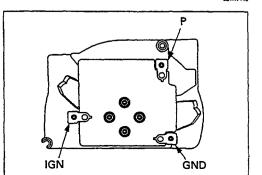
  Note the movement of the tachometer needle.
  - If the needle movement is sluggish, the tachometer must be replaced.



•	rpm
Permissible Range	
940–1060	
1875–2125	
2850–3150	
3820–4180	
4820-5180	
5820–6180	
	940–1060 1875–2125 2850–3150 3820–4180 4820–5180

Diesel engine	
2 r/min 5 1 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
· <del></del>	821RV118

sel engine	1	rpm
Indication	Permissible Range	
750	690-810	
2,000	1875–2125	
3,000	2850-3150	
4,000	3820-4180	
5,000	4820-5180	



## **Tachometer Off-Vehicle Inspection**



Remove the tachometer from the meter assembly and measure the resistance value and the current consumption between each terminal.

#### **Tachometer Resistance**

Tester terminal Terminal symbol	Red (+)	Black (-)	Black ()	Red (+)
IGN – GND	IGN	GND	IGN	GND
	∞ 23 – 3		31k	
P - GND	Р	GND	Р	GND
		φ.	24.7 –	33.4k

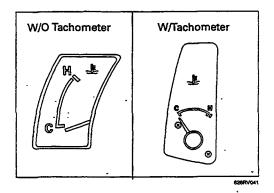
Note: Use the analog type circuit tester (range: x 1k).

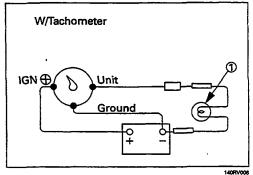
#### **Tachometer Current Consumption**

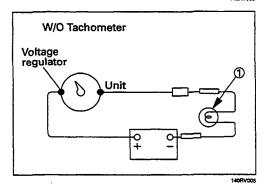
Terminal symbol	Current consumption	Remarks
IGN – GND ⊕ ⊝	90 ± 15 mA (12 ± 1V when voltage applied)	No signal input

Note: 1. Use the analog type circuit tester.

2. Since the current consumption fluctuates as the source voltage varies, check to be sure that the voltage applied is  $12V \pm 1V$ .







#### **TEMPERATURE GAUGE AND THERMO UNIT**



#### **Temperature Gauge On-Vehicle Inspection**

- 1. Disconnect the temperature gauge wire connector.
- Connect a 3.4 Watt test bulb ① to the ground.
   The gauge needle should move the middle part of the gauge



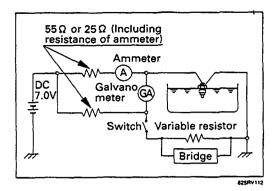
#### **Temperature Gauge Off-Vehicle Inspection**

Use a circuit tester to measure the temperature gauge resistance.

**Temperature Gauge Resistance** 

$\sim$
( )

	Standard		
Measuring Point	With Tachometer	Without Tachometer	
IGN (+) - Ground	130	_	
IGN (+) – UNIT UNIT – Ground	82 212	-	
VOLTAGE REGULATOR – UNIT	_	25	



#### **Thermo Unit Inspection**

The thermo unit is thermistor type and must be inspected under the conditions as shown in the left chart.

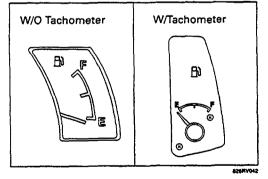
1. Put the deviation of the galvanometer to 0 by using the variable resistor, switch the thermo unit off and then measure the resistance of the resistor through the bridge.

Confirm that the resistance is continuously variable in any other points than those shown in the following table.

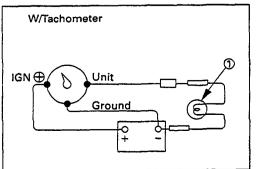
2. Dip the thermo unit into 80 – 90°C (176 – 194°F) water and confirm that there is no bubble continuously coming out of inside of the unit.

Replace the unit when the result of inspection is found abnormal.

Check condition	Temperature	50°C (122°F)	115°C (239°F)
7V 55Ω Gauge	Resistance value	+33.6 226.0 <sup>-36.6</sup>	+1.71 26.4 <sup>-2.21</sup>
7V 25Ω Gauge	(Ω)	_	+2.68 24.3 <sup>-3.68</sup>



#### **FUEL GAUGE AND TANK UNIT**



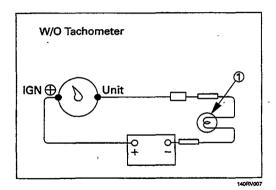
# 10

140RV006

#### Fuel Gauge On-Vehicle Inspection

- 1. Disconnect the fuel gauge wire connector.
- 2. Connect a 3.4 Watt test bulb ① to the ground.

The gauge needle should more the middle part of the gauge.



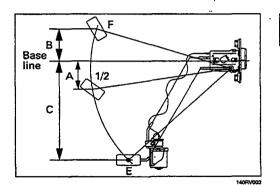
#### **Fuel Gauge Off-Vehicle Inspection**

Use a circuit tester to measure the fuel gauge resistance.



	$\sim$
	.,

	Stand	lard
Measuring Point	With Tachometer	Without Tachometer
IGN (+) - Ground	223	110
IGN (+) - 7V		(0)
IGN (+) - UNIT	83	25
Ground – 7V		110
Ground - UNIT	140	135
7V – UNIT		25



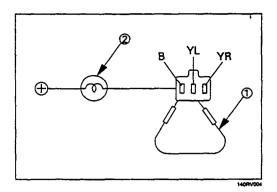


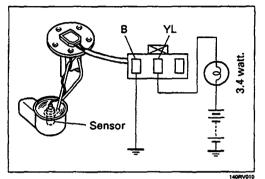
# **Fuel Tank Unit Inspection**

Measure the fuel tank unit resistance between the connector terminals 1  $\boxed{\text{F-1}}$  and 3  $\boxed{\text{F-1}}$  while shifting the float from "E" to "F" point.

**Fuel Tank Resistance** 

Level	Float position mm	Standard resistance Ω
F (B)	51.7	17 ± 2.1
1/2 (A)	49.4	45 ± 4.5
E (C)	166.9	120 ± 6.5







#### **Low Fuel Indicator Light Inspection**

- 1. Disconnect the fuel tank unit wire connector.
- 2. Connect between terminal (YL) and (B).
- 3. Turn the key switch on. Check that the bulb lights.

If operation is not correct, remove and check the bulb or circuit.

#### Check level sensor operation

- 1. Remove the fuel tank unit.
- 2. Apply battery voltage between terminal (YL) and (B) through a 3.4 watt bulb. Check that the bulb lights.



#### Note:

It will take a short time for the bulb light.

3. Submerge the sensor in fuel. Check that the bulb goes out.

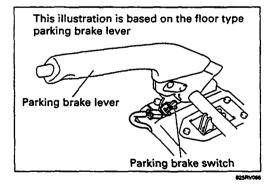
If operation is not correct, replace the fuel tank unit.

#### **BRAKE SYSTEM WARNING LIGHT**

The brake system warning light comes on while the parking brake is set and the starter key is ON position.

#### Note:

The parking brake indicator light circuit is designed to prevent driving of the vehicle with the parking brake on. It does not indicate the condition of the parking brake system.



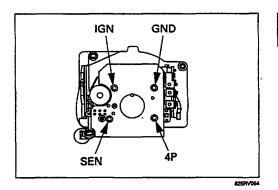
Level mark
Max
Min

330RV00

The parking brake switch is in parallel with the brake fluid switch.

The brake system warning light also comes on when reservoir brake fluid level falls below the specified limit with the parking brake released and the starter switch is ON position.

## **VEHICLE SPEED SENSOR (INCORPORATED IN** THE SPEEDOMETER)





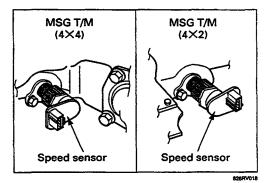
#### Vehicle Speed Sensor Inspection

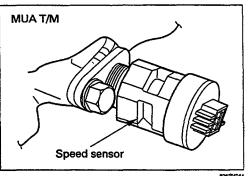
Remove the speedometer from the meter assembly and measure the resistance value between the terminals.

#### **Speed Sensor Resistance**

Tester terminal Terminal symbol	Red (+)	Black (-)	Black ()	Red (+)
4P – GND	4P	GND	4P	GND
4F - GND	13.5 -	- 16.5k	~	>

Note: Use the analog type circuit tester.

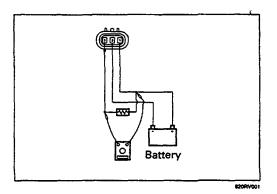




# **VEHICLE SPEED SENSOR (INSTALLED ON THE** TRANSMISSION)

The speed sensor is installed on the rear portion of the transmission.

The number of pulses generated is four pulses per one rotation of the pinion shaft.





#### **Vehicle Speed Sensor Inspection**

- Connect the vehicle speed sensor connector 1 M-10 (Diesel engine: 1 E-44) to the battery (+) terminal and 2 M-10 (Diesel engine: 2 E-44) to the (-) terminal.
- 2. Connect a resistance of 1.3K ohm to 5K ohm (1/4 W or more) between connectors 1 M-10 (Diesel engine: 1 E-44) and 3 M-10 (Diesel engine: 3 E-44)



#### **CAUTION:**

Be extremely careful not to connect the battery (+) terminal to the connector  $3\overline{M-10}$  (Diesel engine:  $3\overline{E-44}$ ).

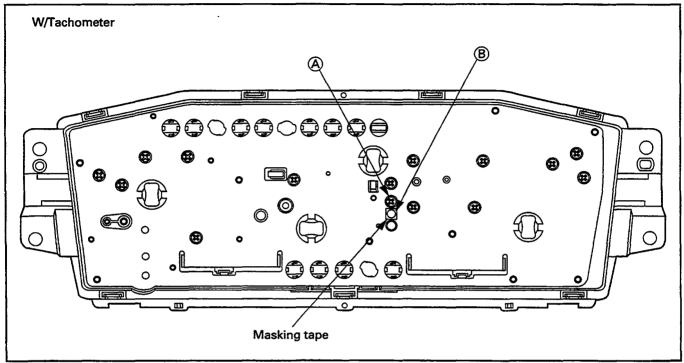
This may damage the vehicle speed sensor.



Rotate the shaft of the vehicle speed sensor slowly and measure the voltage at the both ends with a digital tester.

The voltage, with one rotation of shaft fluctuates four times in the following range: 10 to 14V — 2V or less.

#### Timing Belt Indicator Light Reset Procedure (4JA1-T Diesel Engine - RHD)



821RV120

Timing belt must be replaced after 100,000 km of vehicle operation.

When the odometer reading reaches 100,000 km, the timing belt indicator light will turn on to remind the driver to change the timing belt.

After replacing the timing belt, the timing belt indicator light must be reset to remind the driver to replace the timing belt after the next 100,000 km.

#### **Timing Belt Indicator Light Reset Procedure**

- 1. Remove the masking tape from the hole B.
- 2. Remove the screw from the hole (A) and install it to the hole (B).
- 3. Apply new masking tape to the hole (A).

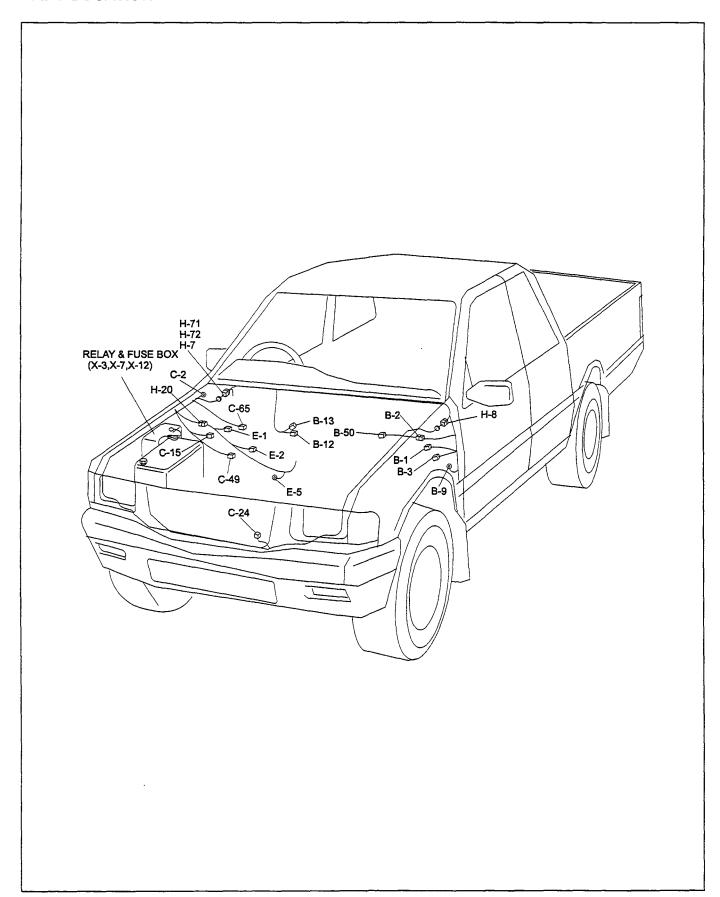
#### Note:

The above procedure assumes that the timing belt is being replaced for the first time (after 100,000 km).

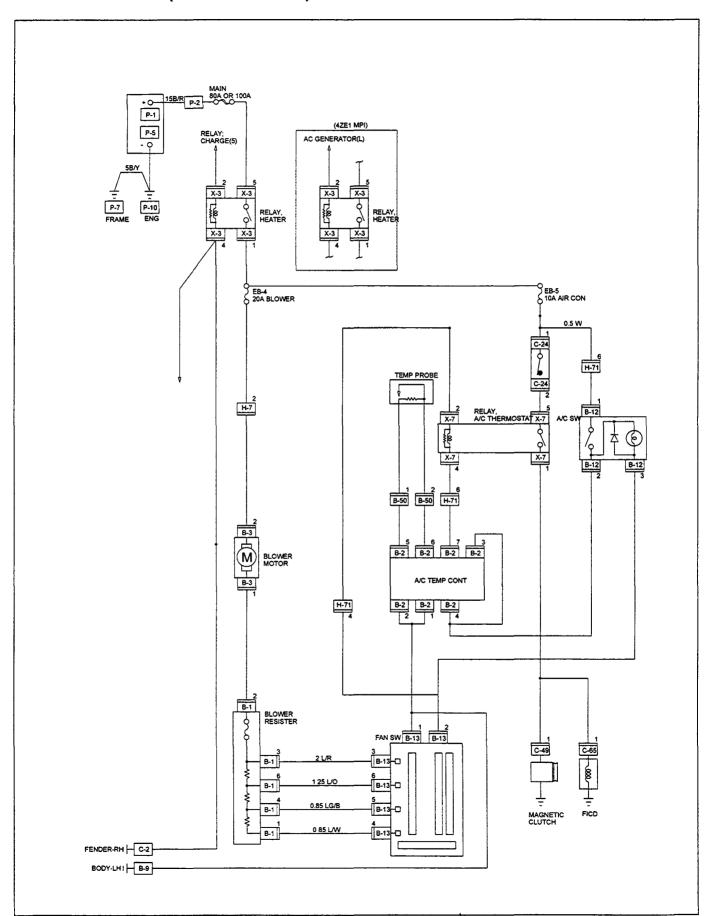
For subsequent reset procedure (at next 100,000 km), hole positions will be the opposite of the above procedure.

# **HEATER AND AIR CONDITIONING**

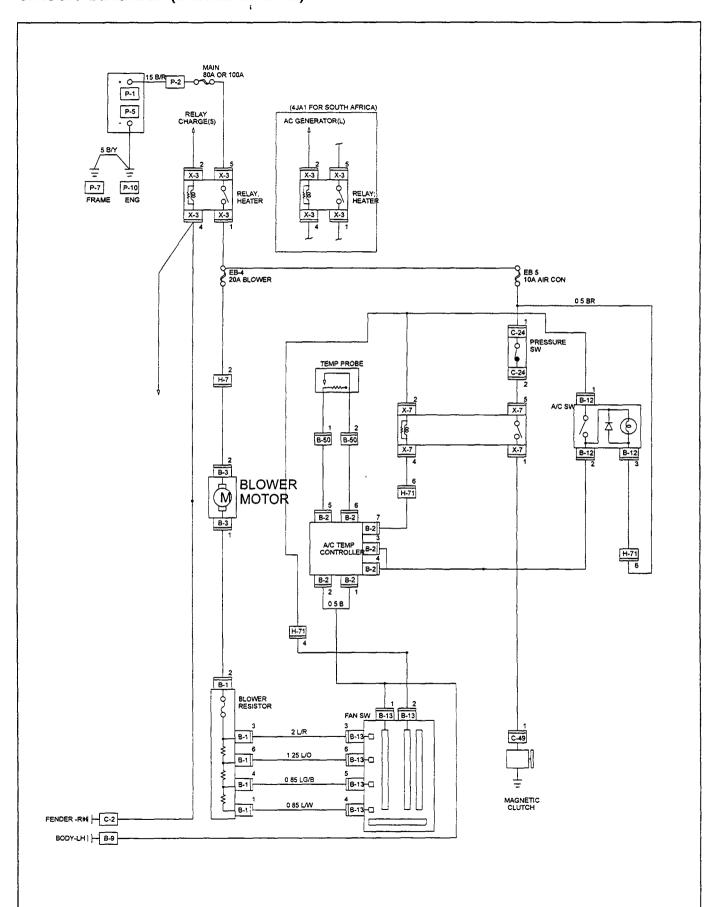
# **PART LOCATION**



# **CIRCUIT DIAGRAM (PETROL ENGINE)**

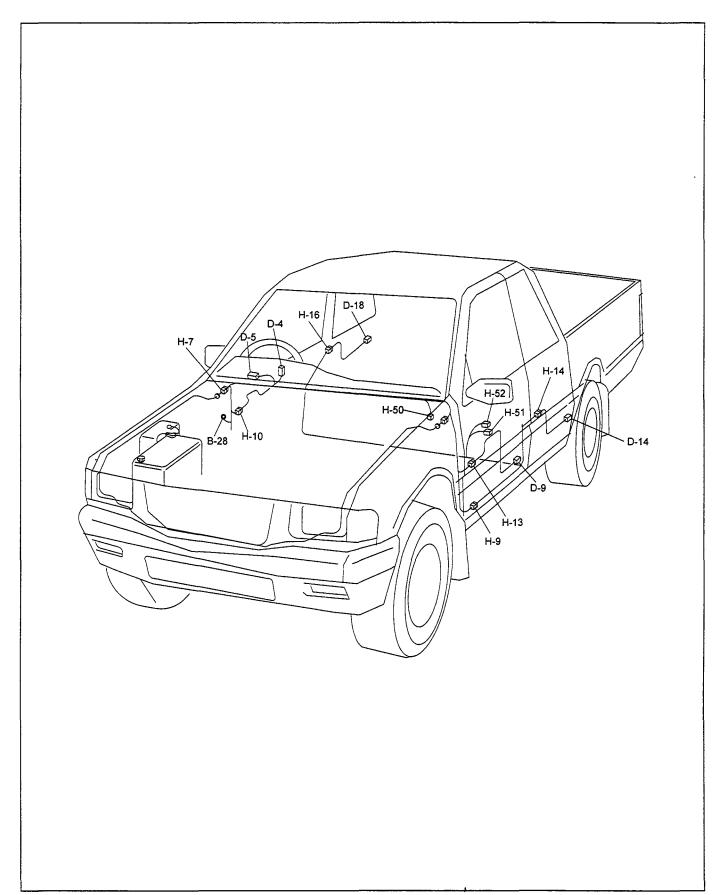


# **CIRCUIT DIAGRAM (DIESEL ENGINE)**

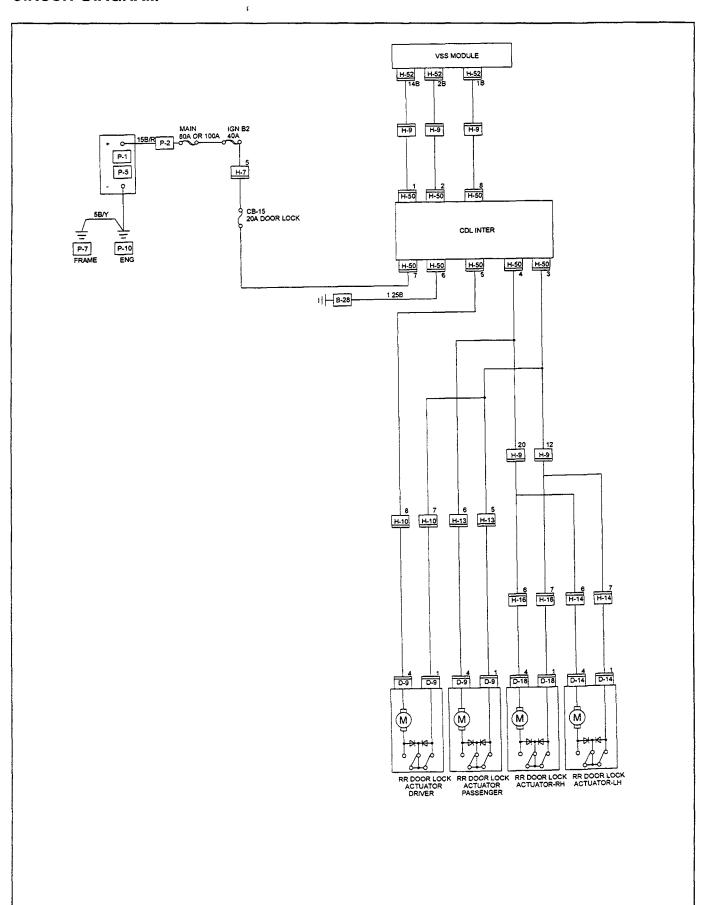


# **POWER DOOR LOCK**

# **PARTS LOCATION**



## **CIRCUIT DIAGRAM**

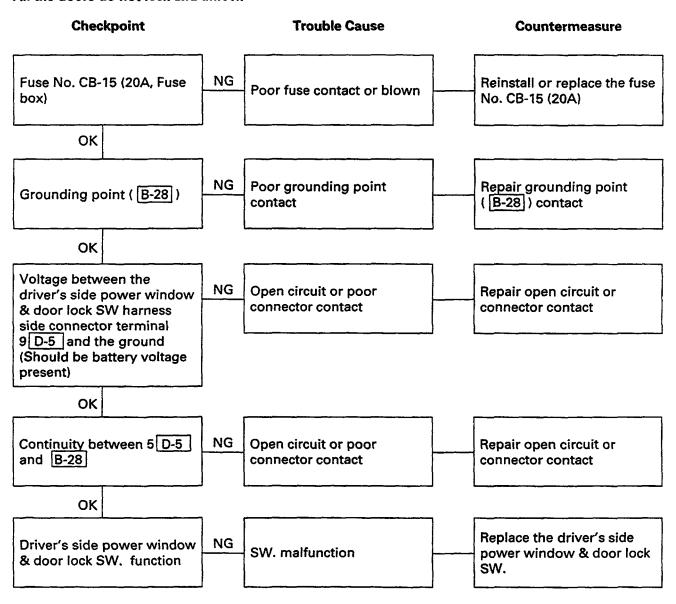


# **TROUBLE SHOOTING**

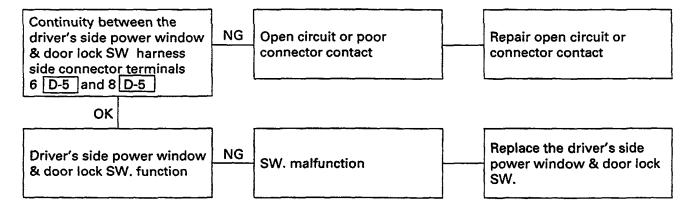
## **QUICK CHART FOR CHECK POINTS**

Check Points	Fuse CB-15	Power Window & Door Lock Switch	ator	Cable			
Trouble Mode	(20A)	Driver's side	Driver's side	Passenger's side	RR-RH	RR-LH	Harness
1. All the doors do not lock and unlock	0	0					0
2. All the doors do not get locked (or unlocked)		0					0
3. Driver's side door does not get locked (or unlocked)			0				0
4. FRT passenger's side door does not get locked (or unlocked)	-			0			0
5. RR door-RH does not get locked (or unlocked)					0		0
6. RR door-LH does not get locked (or unlocked)						0	0
7. Door lock does not operate when operating from the driver's seat side			0				0

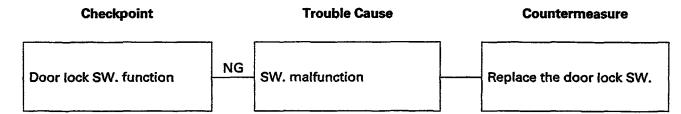
#### 1. All the doors do not lock and unlock



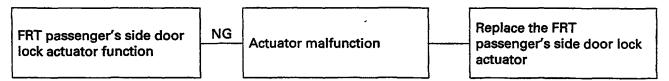
#### 2. All the doors do not get locked (or unlocked)



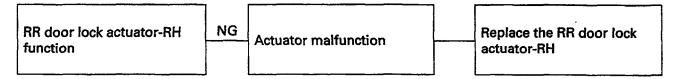
#### 3. Driver's side door does not get locked (or unlocked)



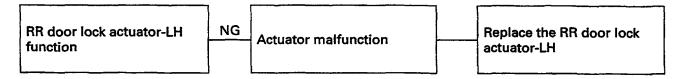
#### 4. FRT passenger's side door does not get locked (or unlocked)



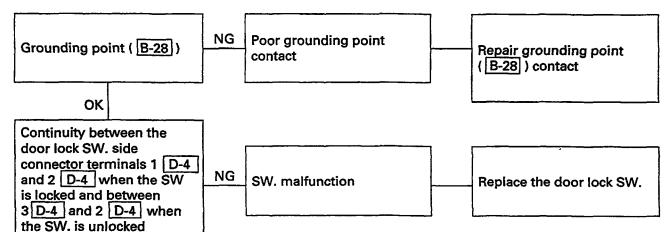
#### 5. RR door-RH does not get locked (or unlocked)



#### 6. RR door-LH does not get locked (or unlocked)



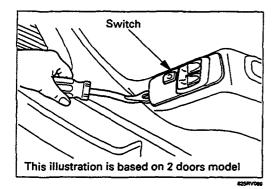
## 7. Door lock does not operate when operated from the driver's seat side







# REMOVAL AND INSTALLATION





# DRIVER SEAT SIDE POWER WINDOW & DOOR LOCK SWITCH

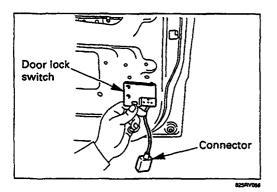
#### Removal

- 1. Remove the switch by pushing the spring with the tip of a screwdriver.
- 2. Disconnect the connector.



#### Installation

To install, follow the removal steps in the reverse order.





#### **DRIVER'S SIDE DOOR LOCK SWITCH**

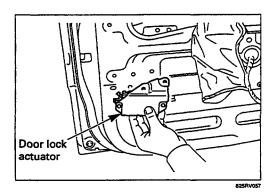
#### Removal

- 1. Door Lock ASM
  - Refer to the removal steps of the DOORS in Section 10 "BODY".
- 2. Door Lock Switch



#### Installation

To install, follow the removal steps in the reverse order.



# FRT PASSENGER'S SIDE DOOR LOCK ACTUATOR



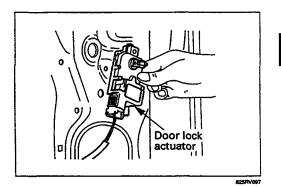
#### Removal

- 1. Door Lock ASM
  - Refer to the removal steps of the DOORS in Section 10 "BODY".
- 2. Door Lock Actuator
  - · Remove the actuator fixing bolts.
  - · Disconnect the door lock link rod.
  - Disconnect the actuator connector.



#### Installation

To install, follow the removal steps in the reverse order.



# **+**+

# RR DOOR LOCK ACTUATOR-LH & RH

#### 1. Door Lock ASM

- Refer to the removal steps of the DOORS in Section 10 "BODY".
- 2. Door Lock Actuator
  - Remove the actuator fixing bolts.
  - Disconnect the door lock link rod.
  - · Disconnect the actuator connector.



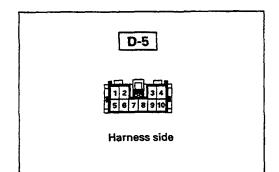
#### Installation

Removal

To install, follow the removal steps in the reverse order.



# **INSPECTION AND REPAIR**

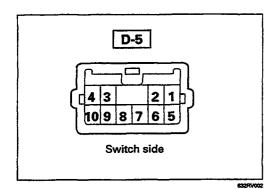


#### **Driver Seat Side Power Window & Door Lock Switch**

## 1. Harness Side Connector Circuit

Check voltage and continuity between the switch harness side connector terminals as shown in the following table.

Terminal No.	Wire color	Connecting to	Check item	Connecting terminal	Check condition		Standard	
	Door lock SW 2 County D		Driver seat	Lock	Continuity			
3	R/W	(Lock)		3-Ground	side door	Unlock	No continuity	
	1.0/5	Door lock SW		4 Carana	Driver seat	Lock	No continuity	
4	4 LG/R	(Unlock)		4-Ground	side door	Unlock	Continuity	
5	В	Ground	Continuity	5-Ground	-	Continuity		
6	L/Y	Door lock actuator (Lock)	(Resistance)	6-8			Continuity There is some resistance	
8	Y/G	Door lock actuator (Unlock)		8-6			Continuity There is some resistance	
9	LG/W	Fuse CB-15 (20A)	Voltage	9- Ground	_	Battery voltage (Approx. 12V)		



#### 2. Switch Side Connector Circuit

Remove the switch connector, and check continuity and voltage between the switch connector terminals.

(Connect the (+) terminal of the battery to 9  $\boxed{\text{D-5}}$  and the (-) terminal to 5  $\boxed{\text{D-5}}$  .)

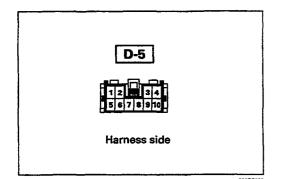
5 D-5 - 6 D-5 . . . . Continuity

5 D-5 - 8 D-5 .... Continuity (Then, ground 3 D-5 .)

6 D-5 .... Current flow for approx. 1 second

(Disconnect the ground of 3 D-5, and ground 4 D-5.)

8 D-5 .... Current flow for approx. 1 second

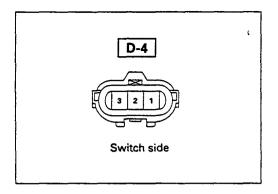


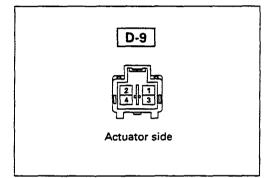
#### 3. Door Lock Operation Test

After confirming that there is continuity between the switch harness side connector terminals 6 D-5 and 8 D-5, apply the battery voltage to each of the terminals to conduct the operation test.

When the door lock will not operate, check the door lock actuator for any trouble.

Connectin	g terminals	Operation				
8 (Y/G)	6 (L/Y)	Operation				
<b>⊕</b>	Θ	Unlock				
Θ	<b>⊕</b>	Lock				





#### **Driver's Side Door Lock Switch**

#### 1. Switch Side Connector Circuit

Check continuity between the switch connector terminals

SW position	1	2	3
Lock	0	<del></del>	
Unlock		0-	-0

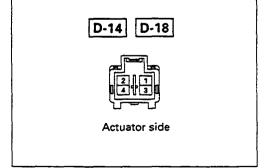
#### Front Passenger's Side Door Lock Actuator

#### 1. Actuator Side Connector Circuit

Apply the battery voltage to the actuator connector terminals to check the operation.

When the door lock actuator is checked on the vehicle and there is no continuity, and when the door lock actuator itself is checked and no trouble is found, check the circuit between the door lock actuator and the driver seat side power window & door lock switch for any failure.

Connectin	g terminals	Operation			
2	4	Operation			
•	Θ	Lock			
Θ	•	Unlock			



#### Rear Door Lock Actuator -LH & RH

#### 1. Actuator Side Connector Circuit

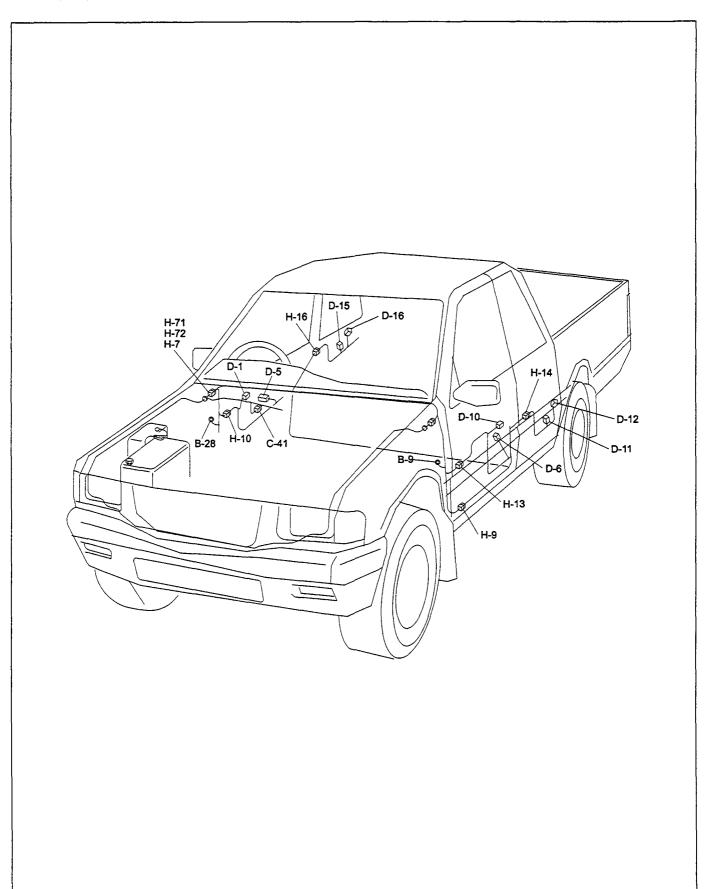
Apply the battery voltage to the actuator connector terminals to check the operation.

When the door lock actuator is checked on the vehicle and there is no continuity, and when the door lock actuator itself is checked and no trouble is found, check the circuit between the door lock actuator and the driver seat side power window & door lock switch for any failure.

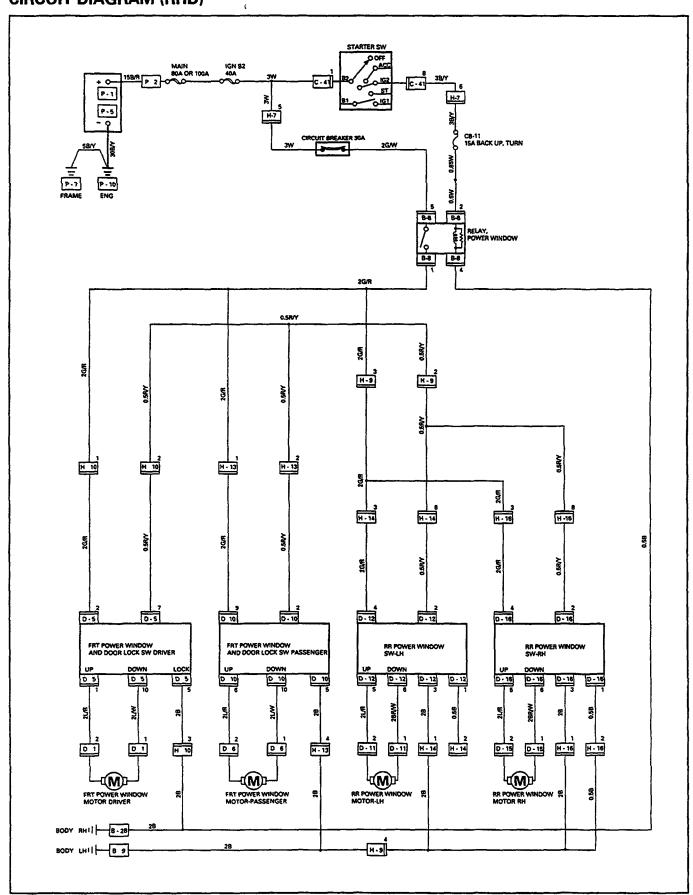
Connecting	g terminals	Operation
1	3	Operation
Θ	•	Lock
•	Θ	Unlock

# **POWER WINDOW**

# **PARTS LOCATION**



## **CIRCUIT DIAGRAM (RHD)**

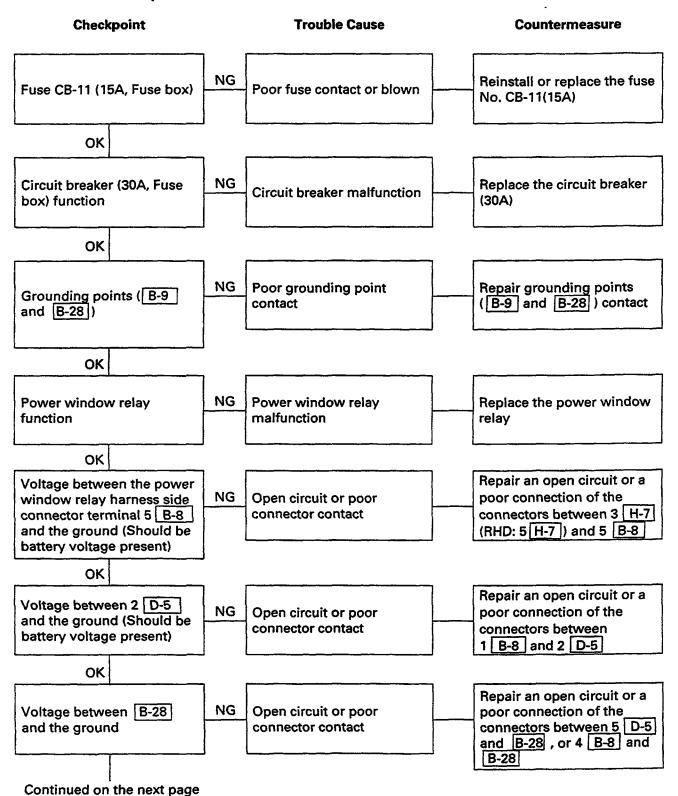


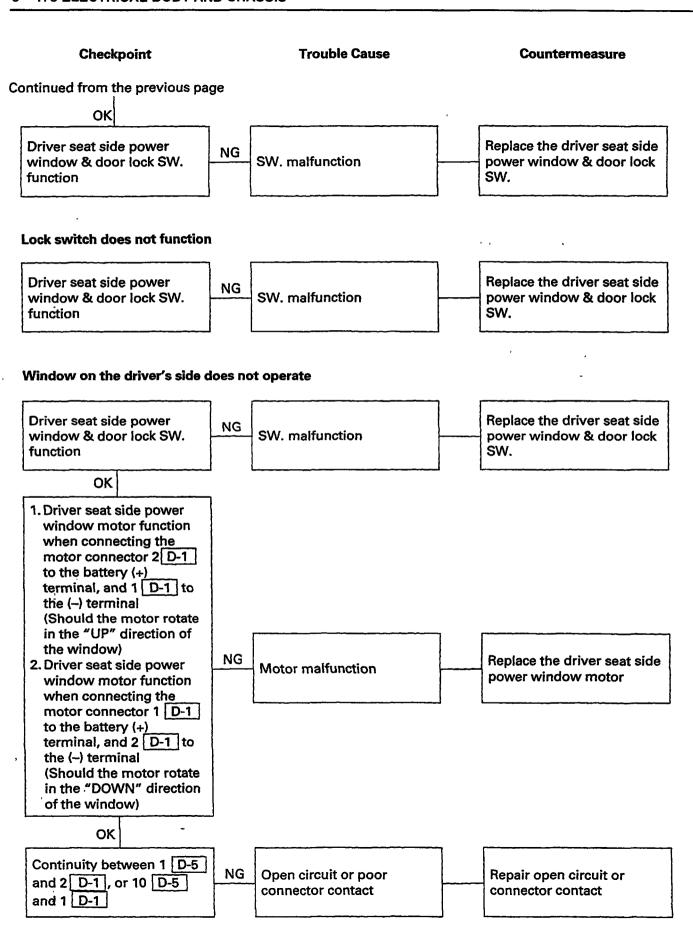
# **TROUBLE SHOOTING**

# QUICK CHART FOR CHECK POINTS

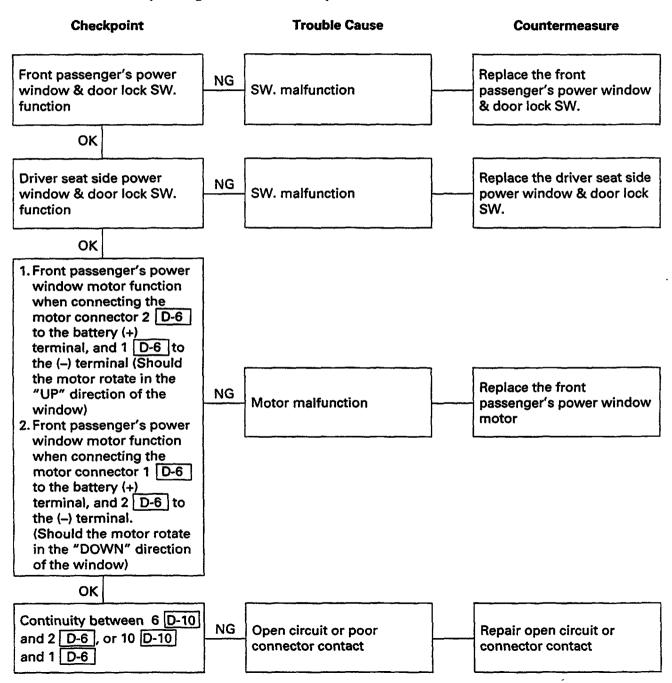
	Check Points											
Trouble Mode			Relay;		Window & ock Switch	Power \ Switch	Vindow	Power Window Motor				Cable
	CB-11 Breaker (15A) (30A)	Power Window	Driver's Side	Passenger's Side	RR-LH	RR-RH	Driver's Side	Passenger's Side	RR-LH	RR-RH	Harness	
All windows will not operate	0	0	0	0								0
Lock SW does not function				0								
Driver's Window:												
Window does not operate	0	0	0	0				0				0
One-touch operation for "DOWN" movement will not operate				0								
Window operates in only one direction				0								
Front window on passenger seat side:												
Window does not operate				0	0				0			0
Window does not operate when operating the driver's SW				0								
Window does not operate when operating the passenger's SW				0	0							0
Window does operate in only one direction when operating the driver's SW				0	0							
Window does operate in only one direction when operating the passenger's seat side SW					0							
Rear window on left (or right) side:												
Window on left (or right) side does not operate				0		0	0			0	0	0
Window does not operate when operating the driver's SW				0								
Window does operate in only one direction when operating the driver's SW				0								
Window does operate in only one direction when operating the RR-LH (or RH) side SW						0	0					0

#### 1. All windows do not operate

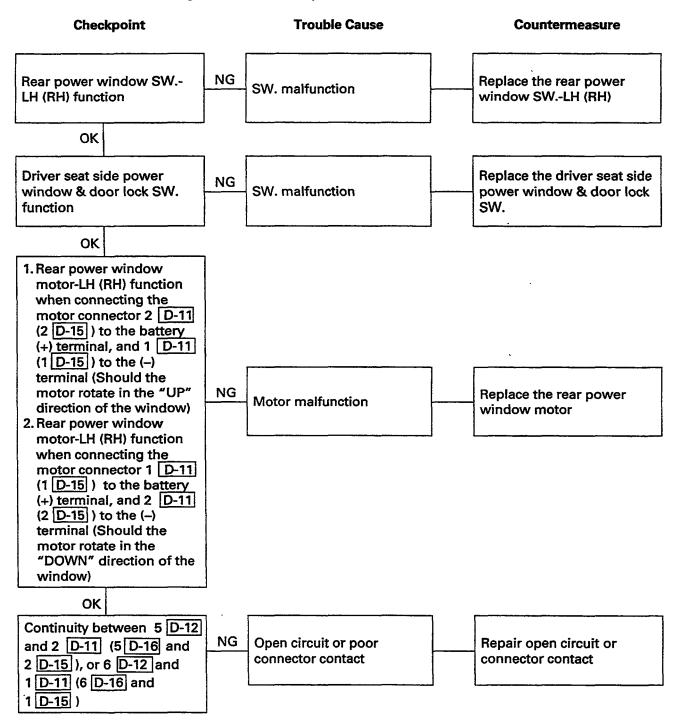




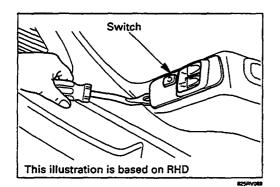
#### 4. Window on the front passenger's side does not operate



#### 5. Rear window on the left (right) side does not operate







# DRIVER SEAT SIDE POWER WINDOW & DOOR LOCK SWITCH (2 DOORS MODEL)



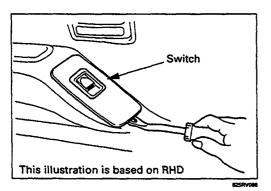
#### Removal

- 1. Remove the switch by pushing the spring with the tip of a screwdriver.
- 2. Disconnect the connector.



#### Installation

To install, follow the removal steps in the reverse order.



# FRONT PASSENGER'S POWER WINDOW & DOOR LOCK SWITCH (2 DOORS MODEL)



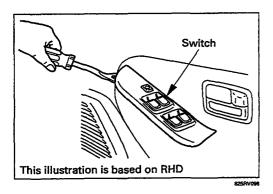
#### Removal

- Remove the switch by pushing the spring with the tip of a screwdriver.
- 2. Disconnect the connector.



#### Installation

To install, follow the removal steps in the reverse order.



# DRIVER SEAT SIDE POWER WINDOW & DOOR LOCK SWITCH (4 DOORS MODEL)



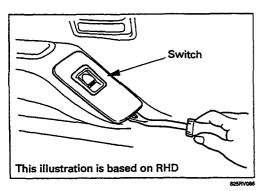
#### Removal

- 1. Remove the switch by pushing the spring with the tip of a screwdriver.
- 2. Disconnect the connector.



#### Installation

To install, follow the removal steps in the reverse order.



# FRONT PASSENGER'S POWER WINDOW & DOOR LOCK SWITCH (4 DOORS MODEL)



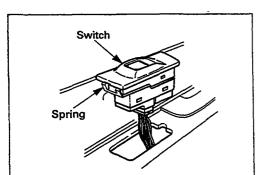
#### Removal

- 1. Remove the switch by pushing the spring with the tip of a screwdriver.
- 2. Disconnect the connector.



#### Installation

To install, follow the removal steps in the reverse order.



# REAR POWER WINDOW & DOOR LOCK SWITCH-LH & RH



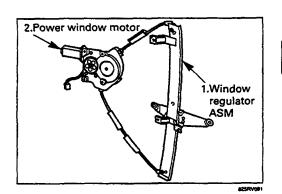
#### Removal

- 1. Remove the switch by pushing the spring with the tip of a screwdriver.
- 2. Disconnect the connector.



#### Installation

To install, follow the removal steps in the reverse order.



#### DRIVER SEAT SIDE POWER WINDOW MOTOR

## Removal

#### 1. Window Regulator ASM

 Refer to the removal steps of the WINDOW REGULATOR/POWER WINDOW MOTOR in Section 10 "BODY".

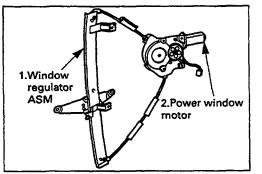
#### 2. Power Window Motor

• Loosen the fixing bolts to remove the power window motor from the regulator.



#### Installation

To install, follow the removal steps in the reverse order.



# FRONT PASSENGER'S POWER WINDOW MOTOR

# **+**+

#### Removal

#### 1. Window Regulator ASM

 Refer to the removal steps of the WINDOW REGULATOR/POWER WINDOW MOTOR in Section 10 "BODY".

#### 2. Power Window Motor

 Loosen the fixing bolts to remove the power window motor from the regulator.



#### Installation

To install, follow the removal steps in the reverse order.

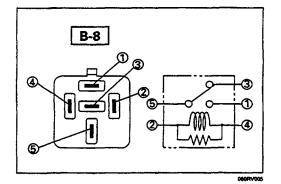


#### **REAR POWER WINDOW MOTOR-LH & RH**

Removal and Installation

Refer to the "DRIVER SEAT SIDE POWER WINDOW MOTOR" removal and installation steps in this section.

# INSPECTION AND REPAIR



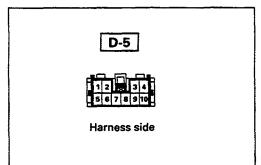
#### **Power Window Relay**

Check continuity between the relay terminals.

① - ⑤ . . . . . . . . . . . No continuity

(When battery voltage is applied between ② and ④)

① - ⑤ . . . . . . Continuity

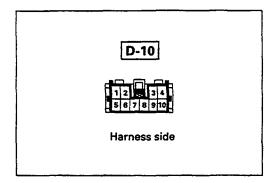


#### **Driver Seat Side Power Window & Door Lock Switch**

#### 1. Harness Side Connector Circuit

Disconnect the switch connector, and check voltage and continuity between the harness side connector terminals as shown in the following table.

Terminal No.	Wire color	Connecting to	Check item Connecting terminal		Check condition	Standard	
2	G/R	Power window relay	Voltage	2-Ground	Starter SW "ON"	Approx. 12V	
1	L/R	Power window	Continuits	1 – 10		Continuity	
10	L/W	motor	Continuity	1 – 10	_	Continuity	
5	В	Ground	Continuity	5-Ground	_	Continuity	

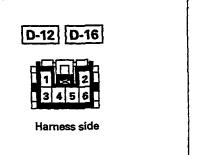


#### Front Passenger's Power Window & Door Lock Switch

#### 1. Harness Side Connector Circuit

Disconnect the switch connector, and check voltage and continuity between the harness side connector terminals as shown in the following table.

Terminal No.	L Lonnectif		Lonnecting to   Check Item		Check condition	Standard	
9	G/R	Power window relay	Voltage	9-Ground	Starter SW "ON"	Approx. 12V	
6	L/R	Power window Continuity	Continuity	6 – 10		Continuity	
10	L/W	motor	Continuity				
5	В	Ground	Continuity	5-Ground	-	Continuity	

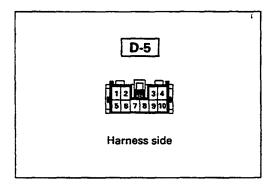


#### **Rear Power Window Switch-LH & RH**

#### 1. Harness Side Connector Circuit

Disconnect the switch connector, and check voltage and continuity between the harness side connector terminals as shown in the following tables.

D-12 (RR-LH)								
Terminal No.	Wire color	Connecting to	Check item	Connecting terminal	Check condition	Standard		
4	G/R	Power window relay	Voltage	4-Ground	Starter SW "ON"	Approx. 12V		
5	L/R	Power window	Continuit	5-6		Camtimuitae		
6	BR/W	motor	Continuity	5-6		Continuity		
3	В	Ground	Continuity	3-Ground	_	Continuity		
			D-16 (RR-	RH)				
Terminal No.	Wire color	Connecting to	Check item	Connecting terminal	Check condition	Standard		
4	G/R	Power window relay	Voltage	4-Ground	Starter SW "ON"	Approx. 12V		
5	L/R	Power window	Continuity	5-6		Continuity		
6	BR/W	motor	Continuity	3-6		Continuity		
3	В	Cd	Continuity	2 1		Continuity		
1	В	Ground	Continuity	3-1	_	Continuity		

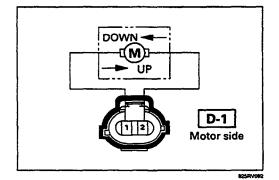


#### **Driver Seat Side Power Window Motor**

# 1. Driver Seat Side Power Window & Door Lock Switch Connector Circuit

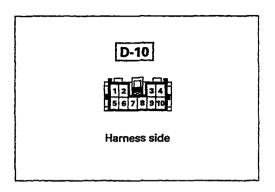
Disconnect the switch connector, apply the battery voltage (12V) to the harness side connector terminals and check operation.

Connectin	g terminals	On anation discretion
1 (L/R)	10 (L/W)	Operation direction
Θ	•	DOWN
<b>⊕</b>	Θ	UP



# 2. Driver Seat Side Power Window Motor Connector Circuit

Connecting	g terminals	Operation discretion
1 2		Operation direction
•	Θ	DOWN
Θ	<b>⊕</b>	UP

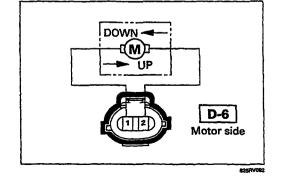


#### Front Passenger's Power Window Motor

# 1. Front Passenger's Power Window Switch & Door Lock Switch Connector Circuit

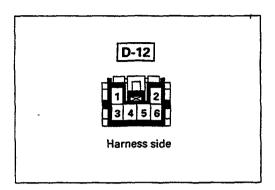
Disconnect the motor connector, apply the battery voltage (12V) to the harness side connector terminals and check operation.

Connectin	g terminals	Operation direction	
6 (L/R)	10 (L/W)	Operation direction	
Θ	•	DOWN	
•	⊖	UP	



# 2. Front Passenger's Power Window Motor Connector Circuit

Connecting	terminals	One metion dispetion	
1	2	Operation direction	
<b>⊕</b>	Θ	DOWN	
Θ	•	UP	

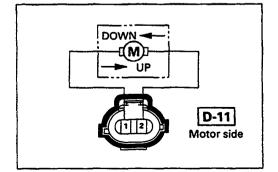


#### Rear Passenger's Power Window Motor-LH

#### 1. Rear Power Window Switch-LH Connector Circuit

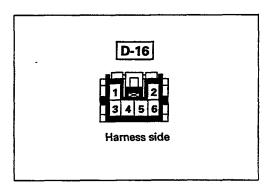
Disconnect the motor connector, apply the battery voltage (12V) to the harness side connector terminals and check operation.

Connectin	g terminals	Operation direction
5 (L/R)	6 (BR/W)	Operation direction
Θ	⊕	DOWN
•	Θ	UP



#### 2. Rear Power Window Motor-LH Connector Circuit

Connectin	g terminals	Operation direction
1 2		Operation direction
•	Θ	DOWN
Θ	•	UP

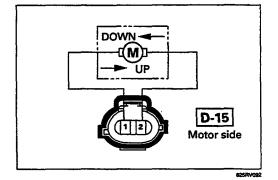


#### **Rear Power Window Motor-RH**

#### 1. Rear Power Window Switch-RH Connector Circuit

Disconnect the motor connector, apply the battery voltage (12V) to the harness side connector terminals and check operation.

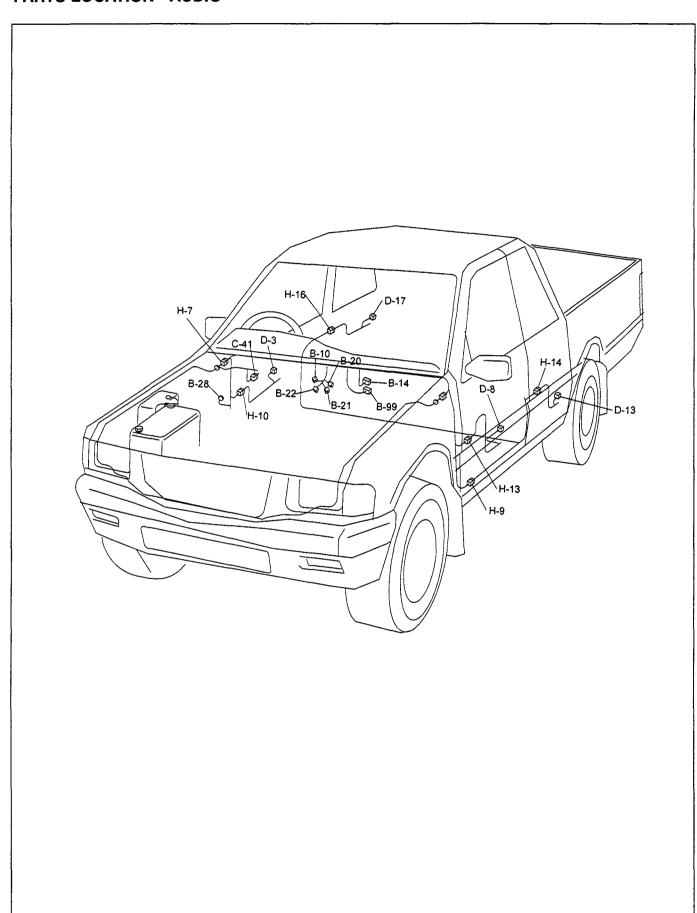
Connectin	g terminals	Oneretion direction	
5 (L/R) 6 (BR/W)		Operation direction	
$\Theta$	<b>⊕</b>	DOWN	
<b>⊕</b>	Θ	UP	



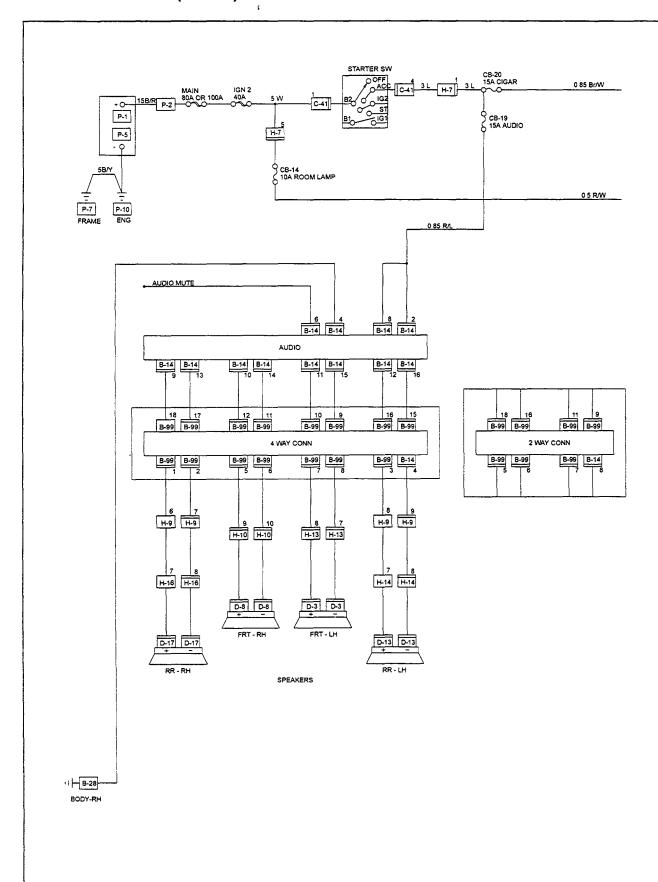
#### 2. Rear Power Window Motor-RH Connector Circuit

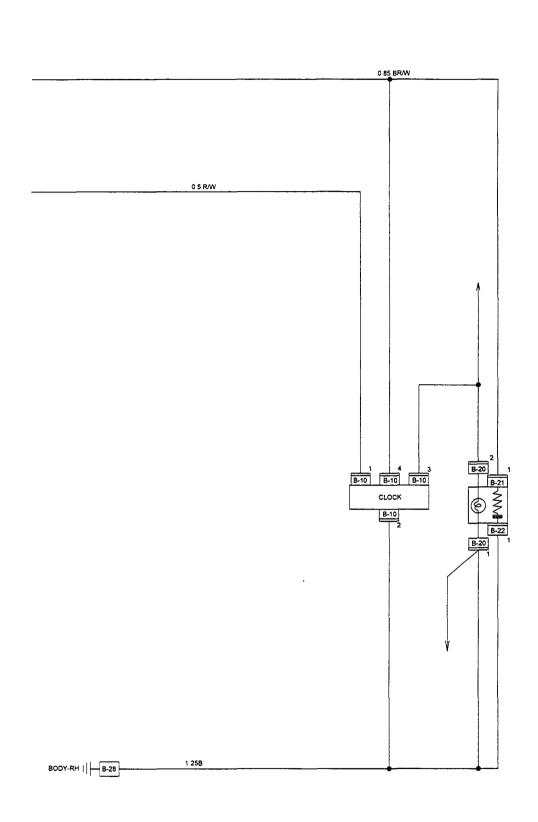
Connectin	g terminals	Operation direction
1 2		Operation direction
•	Θ	DOWN
Θ	•	UP

## **PARTS LOCATION - AUDIO**



## **CIRCUIT DIAGRAM (RADIO)**





#### TROUBLE SHOOTING

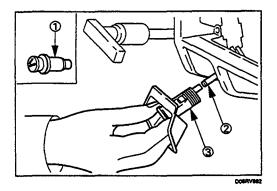
**CIGARETTE LIGHTER** Lighter does not pop out after being pushed in. It does not become hot. Checkpoint **Trouble Cause** Countermeasure NG Audio system (System Poor Fuse No. CB-20 (15A. Reinstall or replace the fuse should receive power) Fuse box) contact or blown No. CB-20 (15A) OK NG Lighter continuity between Open circuit or poor Replace the lighter connector contact center part and outer area OK Voltage between connector 1 B-21 and the ground at NG Open circuit or poor Repair open circuit or starter SW, is ACC position connector contact connector contact (Should be battery voltage present) OK Continuity between NG Open circuit or poor Repair open circuit or connector 1 B-22 and the connector contact connector contact ground 2. Lighter pops out prematurely before becoming hot NG Repair or replace the lighter Lighter and casing Deformed lighter or casing and/or casing 3. Lighter becomes too hot NG Deformed lighter and Repair or replace the lighter Lighter and casing casing and/or casing



### **REMOVAL AND INSTALLATION**

#### **AUDIO**

Refer to Section 9 "ACCESSORIES" for details.



#### **CIGARETTE LIGHTER**

# <del>++</del>

#### Removal

- 1. Remove the lighter (1).
- 2. Disconnect the connector 2.
- 3. Loosen the lighter holder ③ nut at the back side.
- 4. Remove the holder from the bezel.



#### Installation

Follow the removal procedure in the reverse order to install the lighter.



Pay close attention to the important points mentioned in the following paragraphs.

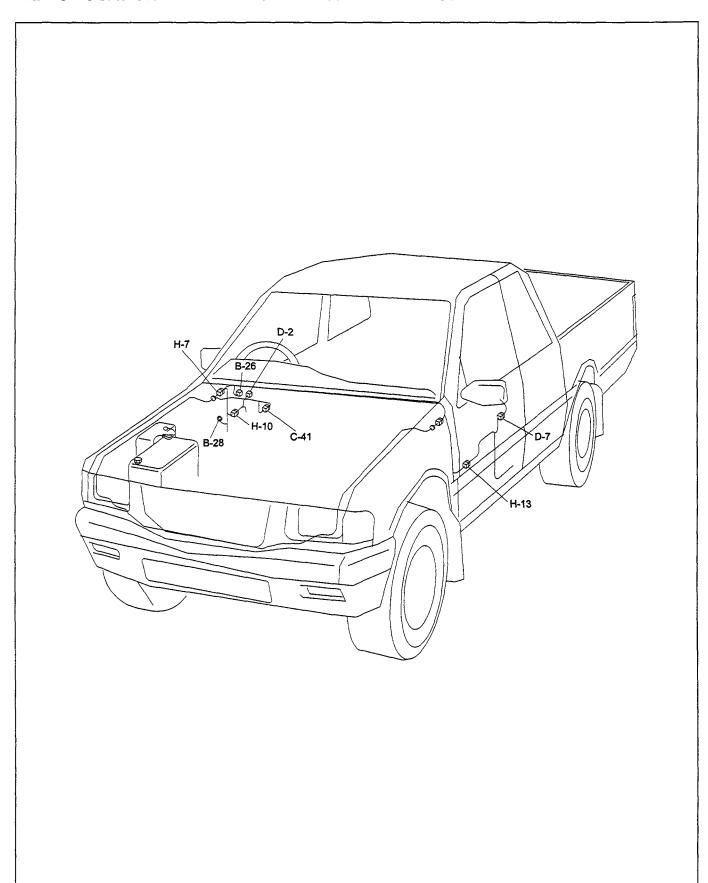
#### Connector

Be absolutely sure that the lighter connector is securely connected.

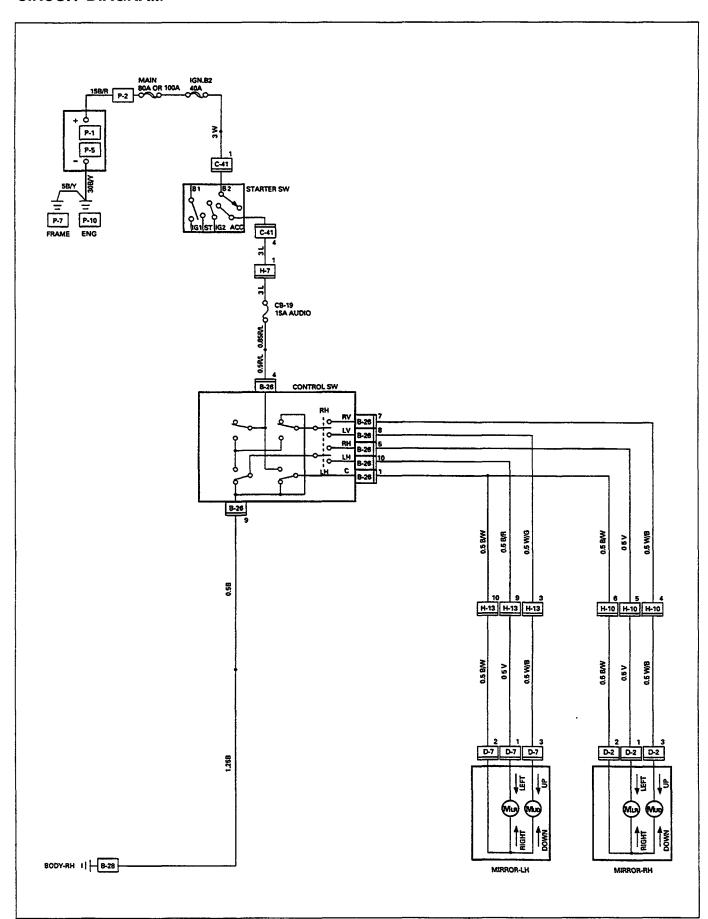
This will prevent a poor contact and an open circuit.

# POWER DOOR MIRROR

## PARTS LOCATION - NOT APPLICABLE MODEL YEAR 1997



### **CIRCUIT DIAGRAM**



#### **TROUBLE SHOOTING**

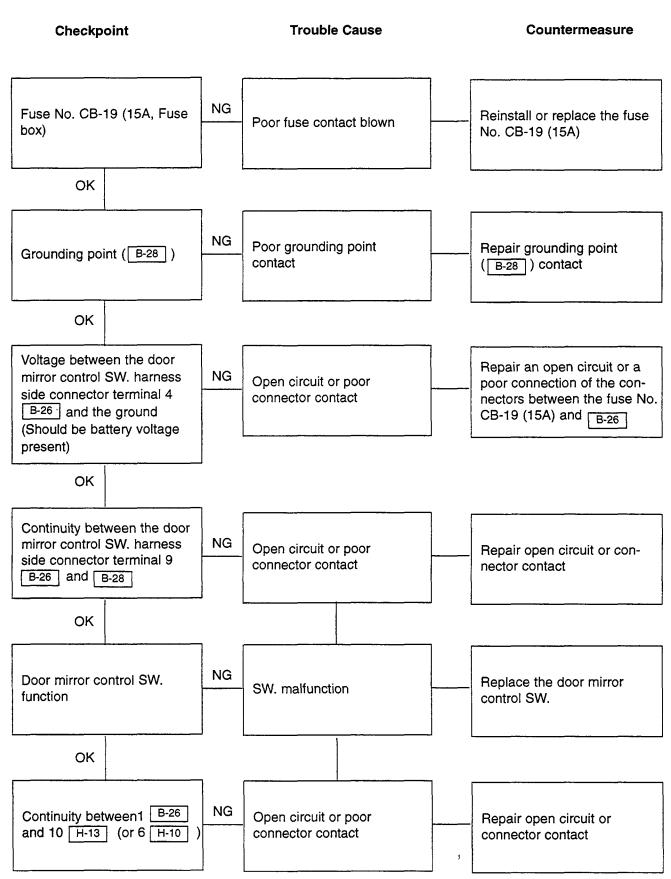
#### QUICK CHART FOR CHECK POINTS

Check Po	ints Fus	Door Mirr	or Doo	r Mirror	Cable
Trouble Mode	CB-1 (15A	- 1	LH	RH	Harness
Mirror on the both sides do not operate	0	0			0
Mirror on the left (or right) side go not operate	pes	0	0	0	0
Mirror on the both sides operate only in the vertical (or horizontal) direction		0			
Mirror on the left side operates or in the vertical (or horizontal) direction	nly	0	0		0
Mirror on the right side operates only in the vertical (or horizontal) direction		0		0	0

#### TROUBLE SHOOTING

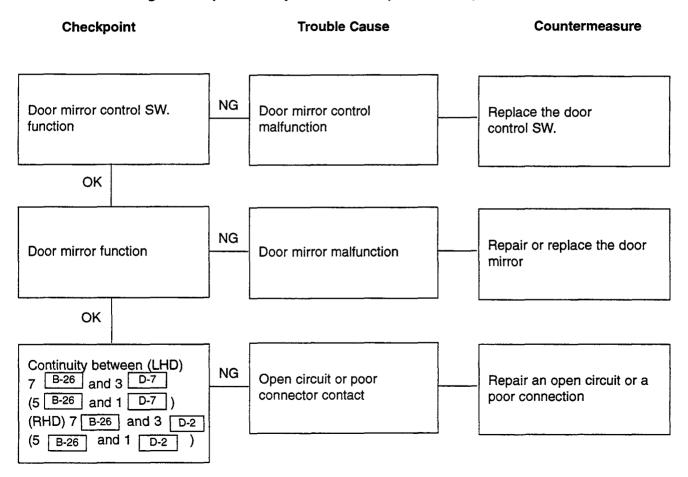
#### DOOR MIRROR CONTROL SWITCH

1. Mirrors on the both sides do not operate



#### Mirror on the left (or right) side does not operate 2. **Trouble Cause** Checkpoint Countermeasure NG Door mirror control SW. Replace the door mirror SW. malfunction function control SW. OK NG Mirror function on the left Mirror malfunction on the Repair or replace the door (or right) side left (or right) side mirror OK Continuity between (LHD) NG 1 B-26 and 2 D-2 Open circuit or poor Repair an open circuit or a connector contact poor connection (1 B-26 and 2 D-7) (RHD) 1 B-26 and 2 D-7 (1 B-26 and 2 D-2 Mirrors on the both sides operate only in the vertical (or horizontal) direction NG Door mirror control SW. Replace the door mirror SW. malfunction function control SW. Mirror on the left side operates only in the vertical (or horizontal) direction Door mirror control SW. Replace the door mirror SW. malfunction NG function control SW. OK Repair or replace the door Door mirror function Door mirror malfunction NG mirror OK Continuity between (LHD) NG 8 B-26 and 3 D-2 Open circuit or poor Repair an open circuit or a connector contact poor connection 10 B-26 and 1 D-2 ) (RHD) 8 B-26 and 3 D-7 (10 B-26 and 1 7

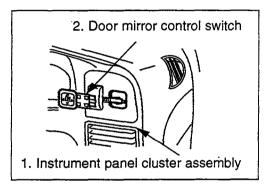
#### 5. Mirror on the right side operates only in the vertical (or horizontal) direction







# **REMOVAL AND INSTALLATION**





#### DOOR MIRROR CONTROL SWITCH

#### Removal

- 1. Instrument Panel Cluster Assembly
  - Refer to section 10 "BODY" for instrument panel cluster assemble by removal steps.
- 2. Door Mirror Control Switch
  - · Disconnect the switch connector.
  - To remove the switch, push the lock from the back side of the cluster assembly.



#### Installation

To install, follow the removal steps in the reverse order.



#### **DOOR MIRROR**

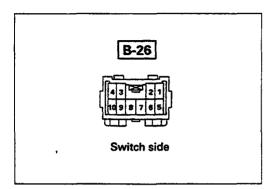
Removal and Installation



Refer to DOOR MIRROR in section 10 "BODY".



## **INSPECTION AND REPAIR**

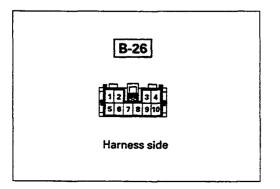


#### **Door Mirror Control Switch**

#### 1. Switch Side Connector Circuit

Check continuity between the switch connector terminals while operating the door mirror control switch as shown in the following table.

	Conne	ector No.							
			4	9	1	8	10	7	5
Switch position								:	;
	Δ	(Up)	0	<u> </u>	<b>-</b>			<u> </u>	0
	$\nabla$	(Down)	0	<u> </u>	o l			0	
Door mirror (RH)	◁	(Left)	0						0
	$\triangleright$	(Right)	0	0	ρ				0
	Δ	(up)	0	0		0			
	$\nabla$	(Down)	ò	0	9				
Door mirror (LH)	◁	(Left)	0	<u> </u>		-0	<del></del>	]	
	$\triangleright$	(Right)	<u> </u>	0			0		

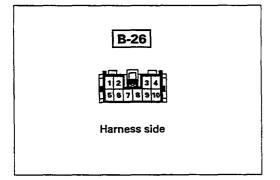


#### 2. Harness Side Connector Circuit

Remove the connector No. B-26 of the mirror control switch and check voltage and continuity of the harness side connector.

 When there is no continuity at the terminal No. 5, 7, 8 and 10, it is considered that the circuit with terminal No. 1 (B/W) is defective. • When there is no continuity at either one of the circuit No. 5, 7, 8 or 10, the motor in the mirror of the circuit itself is defective.

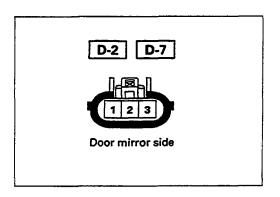
Terminal No.	Wire colour	Connecting to	Check item	Connecting terminal	Check condition	Standard
1	B/W	LH mirror & RH mirror	Continuity	1-Ground	-	No continuity
4	R/L	Fuse CB-19 (15A)	Voltage	4-Ground	Starter SW "ACC" position	Approx. 12V
5	٧	RH mirror-LH/RH		5-1	-	
7	W/B	RH mirror-Up/Down		7-1	-	
8	W/G	LG mirror-Up/Down	Continuity	8-1	-	Continuity
9	В	Ground		9-Ground	•	
10	B/R	LH mirror-LH/RH		10-1	•	



#### **Door Mirror**

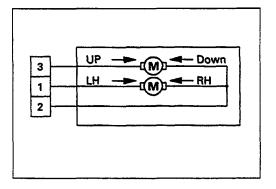
1. Door Mirror Control Switch Connector Circuit
Disconnect the switch connector (B-26),
apply the battery voltage to the harness side connector terminals and check its function.

Conn	B-26				Operating		
Ter	Terminal						direction
Mirror	No.	10	5	1	8	7	
			<b>①</b>	Θ			Left
Diaht	Bish		Θ	<b>①</b>			Right
Right Mirror				Θ		$\oplus$	Up
				$\oplus$		0	Down
				Θ			Left
Left Mirror	Left ⊕	<b>①</b>		$\oplus$			Right
	•			Θ	$\oplus$		Up
				$\oplus$	Θ		Down





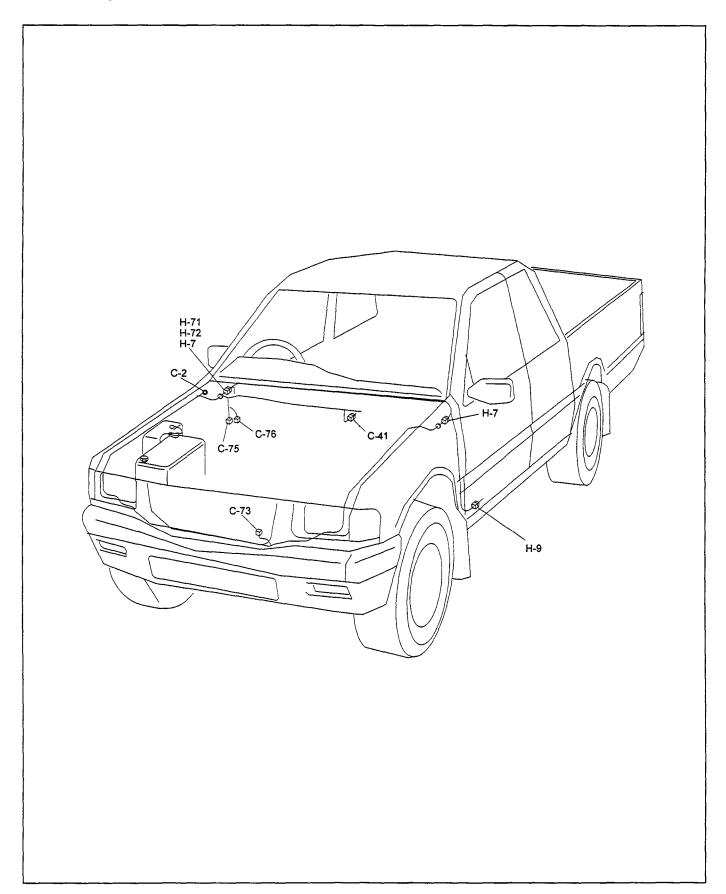
Disconnect the door mirror connector, apply the battery voltage to the door mirror side connector ( $\boxed{\text{D-2}}$  and  $\boxed{\text{D-7}}$ ) terminals and check its function.



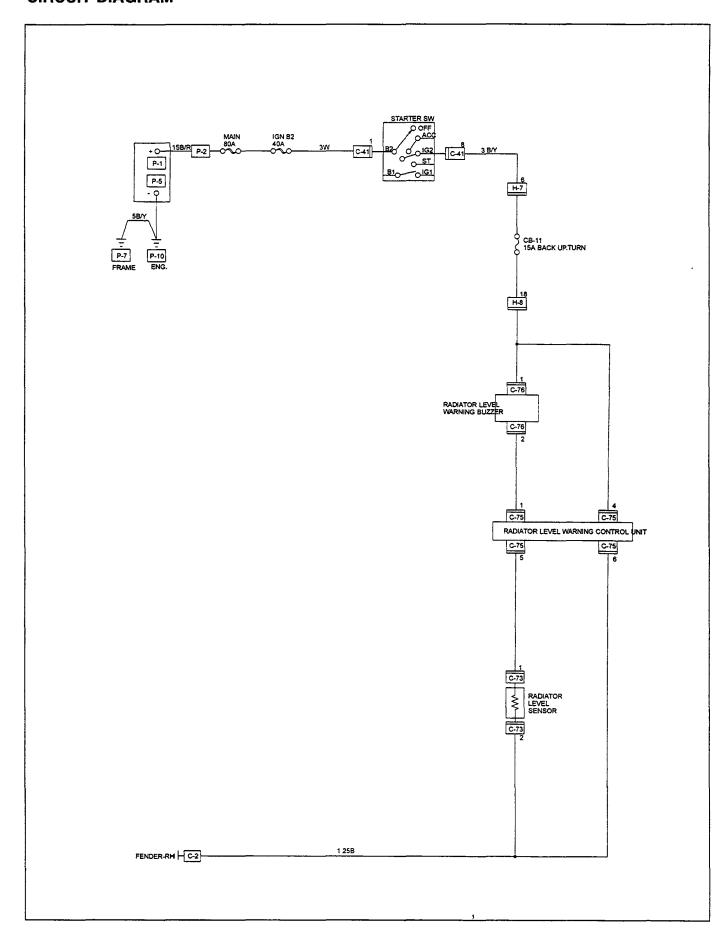
Connector No.	D-2 D-7				
Terminal					
Operation No.	1	2	3		
Up		Θ	<b>•</b>		
Down		$\oplus$	Θ		
Left	$\oplus$	Θ			
Right	Θ	<b>•</b>			

# RADIATOR LEVEL CONTROL WARNING SYSTEM

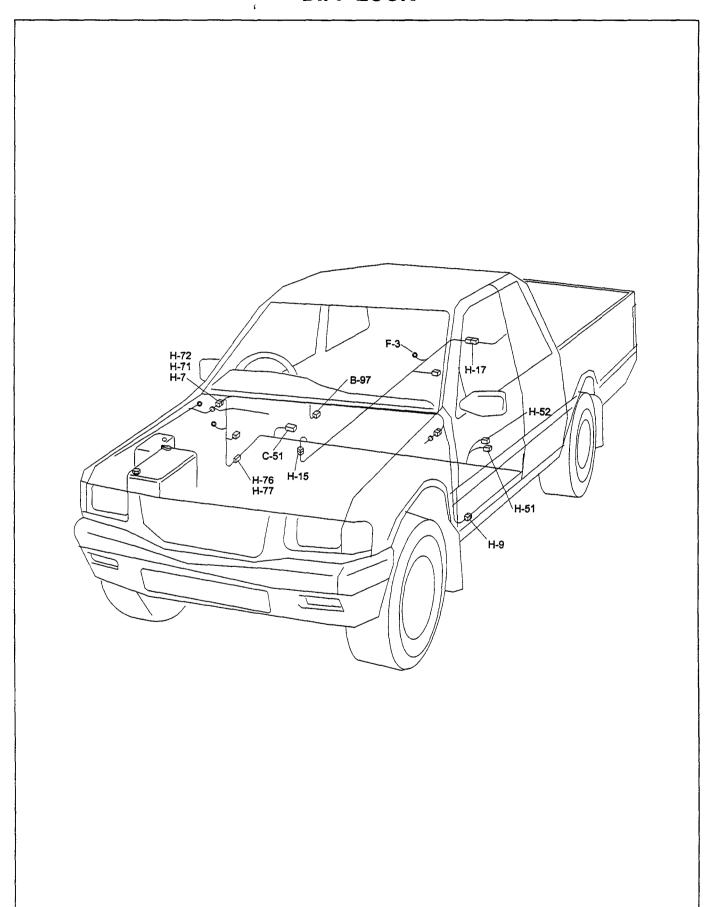
## **PARTS LOCATION**



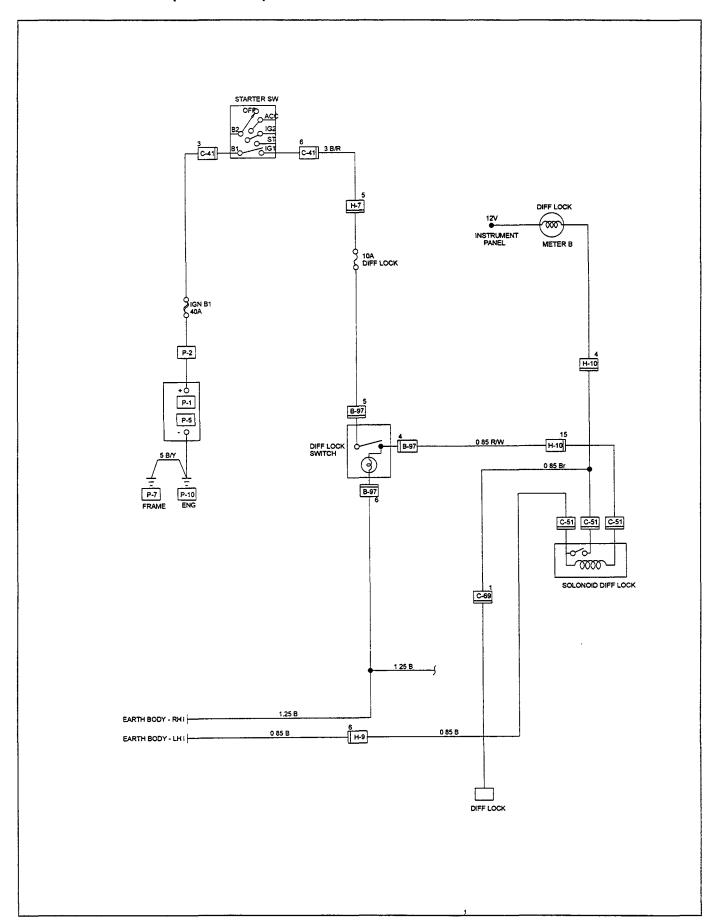
### **CIRCUIT DIAGRAM**



# **DIFF LOCK**



## **CIRCUIT DIAGRAM (DIFF LOCK)**



## TROUBLE SHOOTING

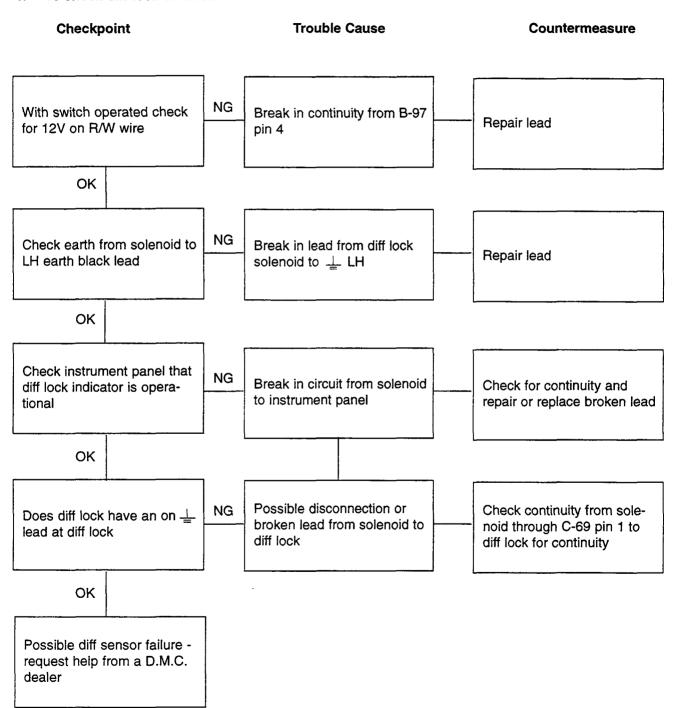
### **DIFF LOCK**

### 1. Diff-lock switch operation and test

Checkpoint	Trouble Cause	Countermeasure		
Check fuse Diff lock	NG Poor fuse contact or blown	Reinstall or replace the fuse		
ок				
Does switch illumination light up	NG With switch operation check operation continuity between pin 5 & 6	Replace switch		
ОК				
Check for power on B-97 pin 5 to C-41 pin 6	NG Poor contact or broken	Repair load		
ОК				
Grounding between B-97 and body 🛓 right	NG Poor contact or broken lead	Repair Ground		

#### TROUBLE SHOOTING

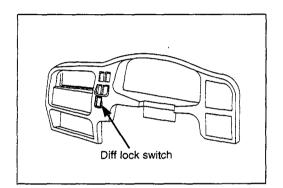
#### 1. To check diff lock solenoid







# REMOVAL AND INSTALLATION

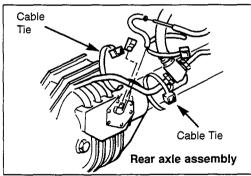


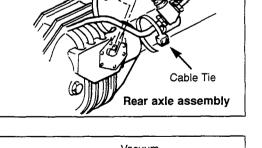


### **DIFF LOCK SOLENOID**

#### Removal

- 1. Remove driver seat as shown in section 10
- 2. Tilt carpet to reveal diff lock solenoid.
- 3. Follow test procedure as shown in Troubleshooting
- Replace Diff Lock solenoid if faulty.



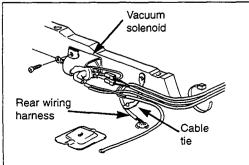




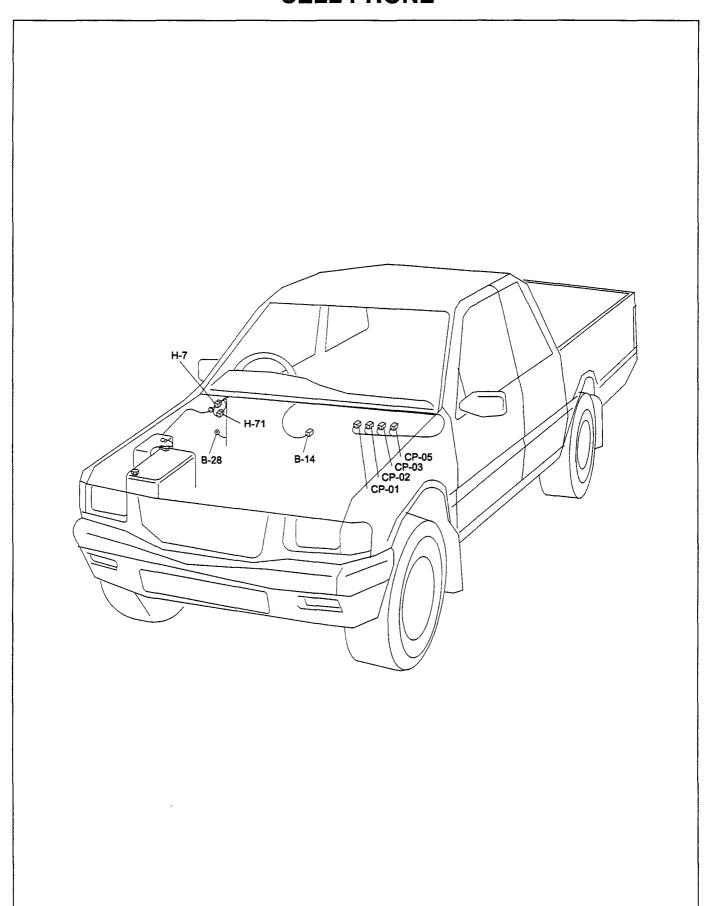
#### Installation

Follow REMOVAL procedure in reverse.

Note: Refer section 10 for removal and installation of driver seat.

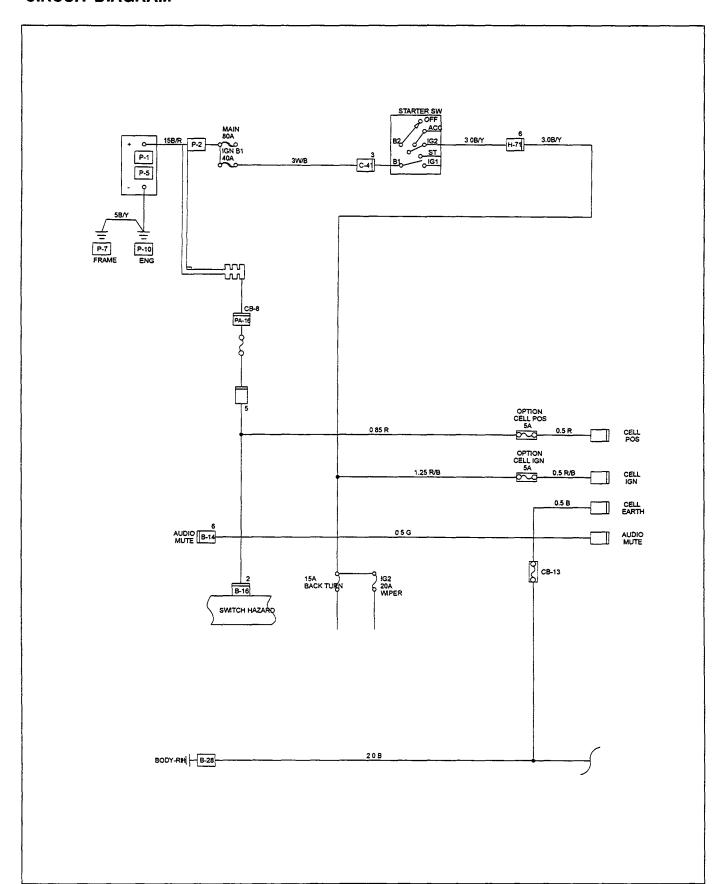


# **CELL PHONE**



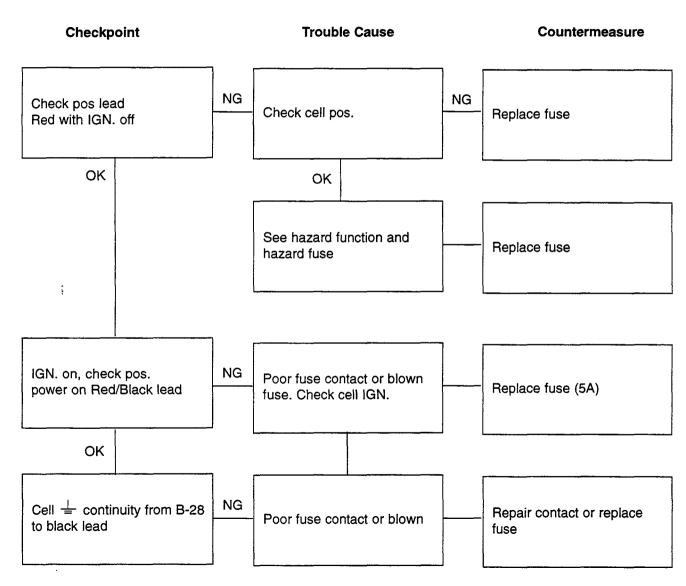
# **CELL PHONE LEADS**

### **CIRCUIT DIAGRAM**

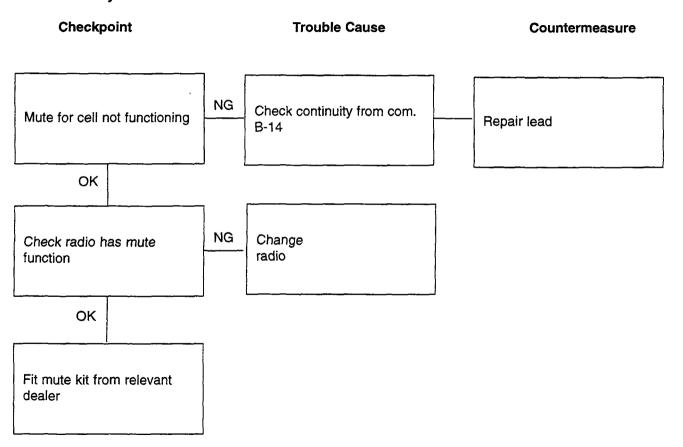


#### TROUBLE SHOOTING

#### **Cell Phone Leads**



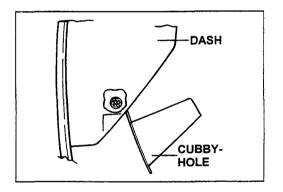
### **Mute Facility**







# **REMOVAL AND INSTALLATION**

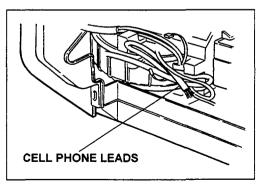




# **CELL LEAD**

### Removal

- 1. Open glove box and unclip from its open position.
- 2. Cut the tie strap holding cell phone leads in place.
- 3. Connect cell phone kit to leads supplied.



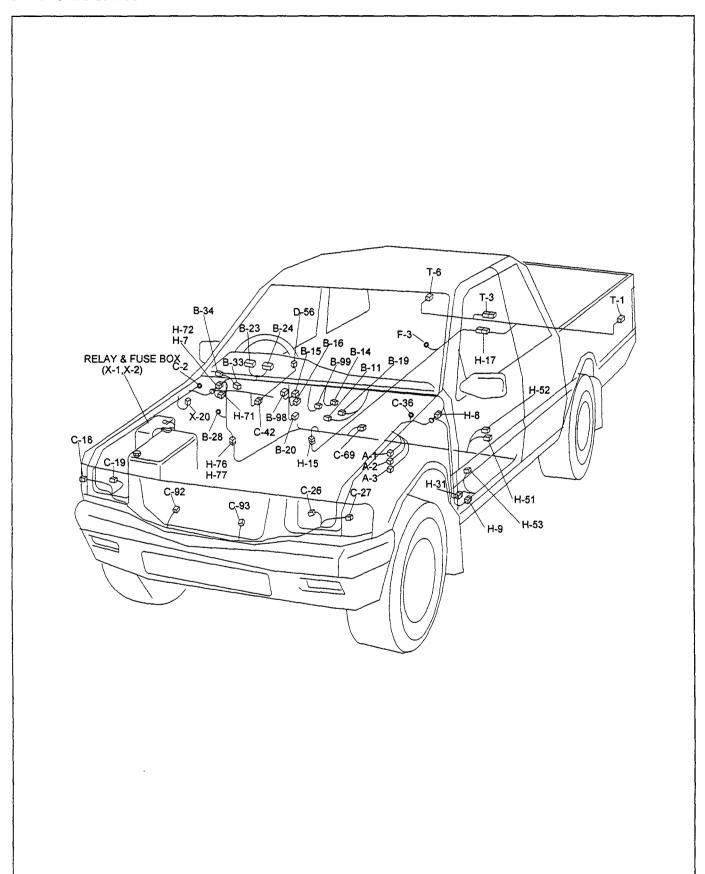


# Installation

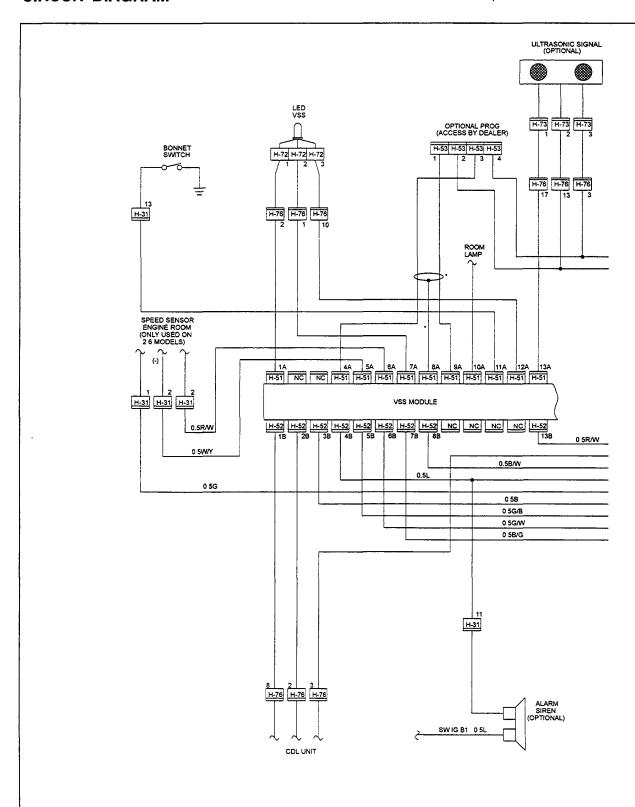
- 1. Fit new tie strap to secure cell phone leads.
- 2. Push close box back into closed position.

# **VEHICLE SECURITY SYSTEM**

# **PARTS LOCATION**

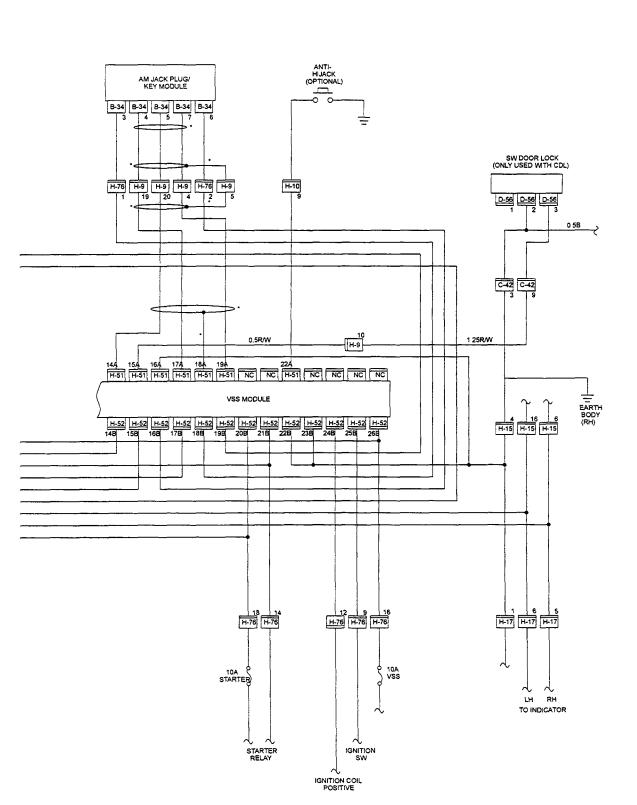


# **CIRCUIT DIAGRAM**



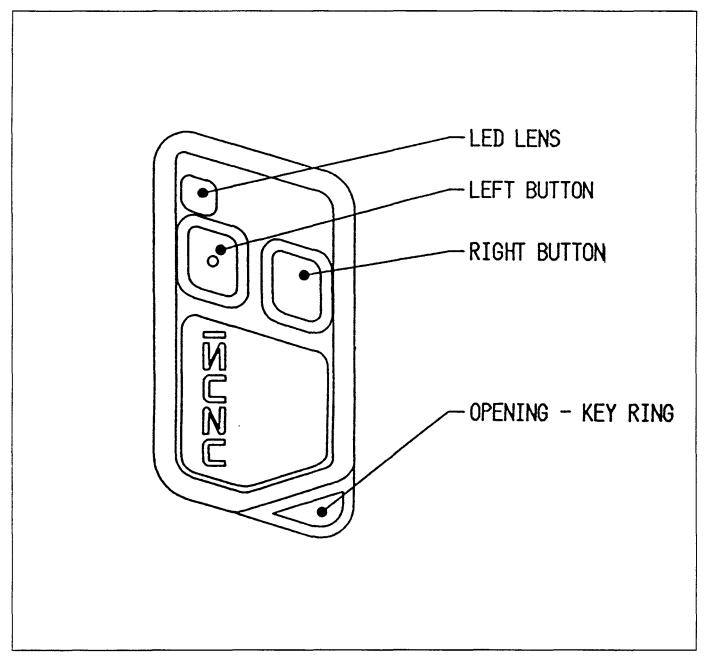
\* SCREEN WIRE

# **CIRCUIT DIAGRAM**



\* SCREEN WIRE

# **VEHICLE SECURITY SYSTEM**



# Operation

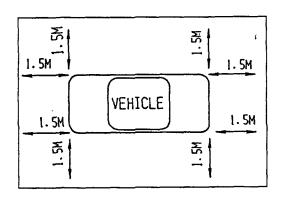
Resynchronise AM key.

# **Key Action**

Press both buttons simultaneously,

# Comment

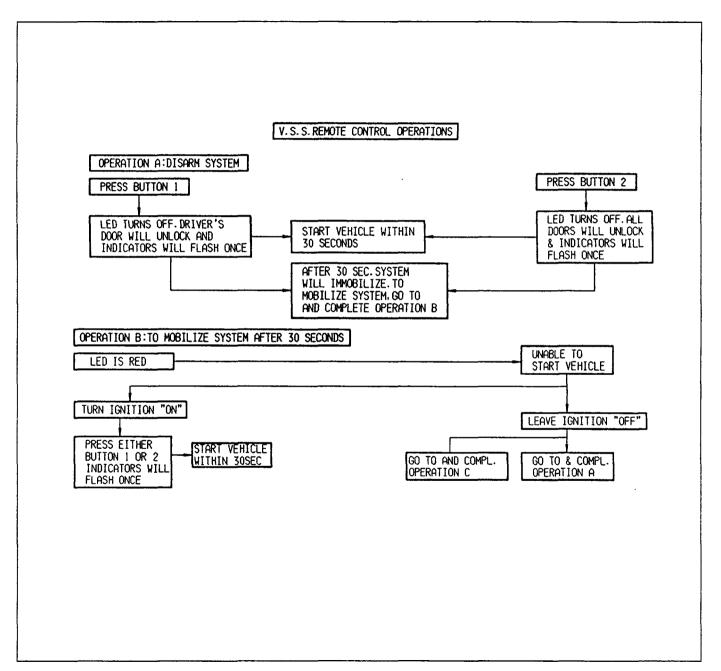
Hold down until led stop flashing and turn on (2SEC).



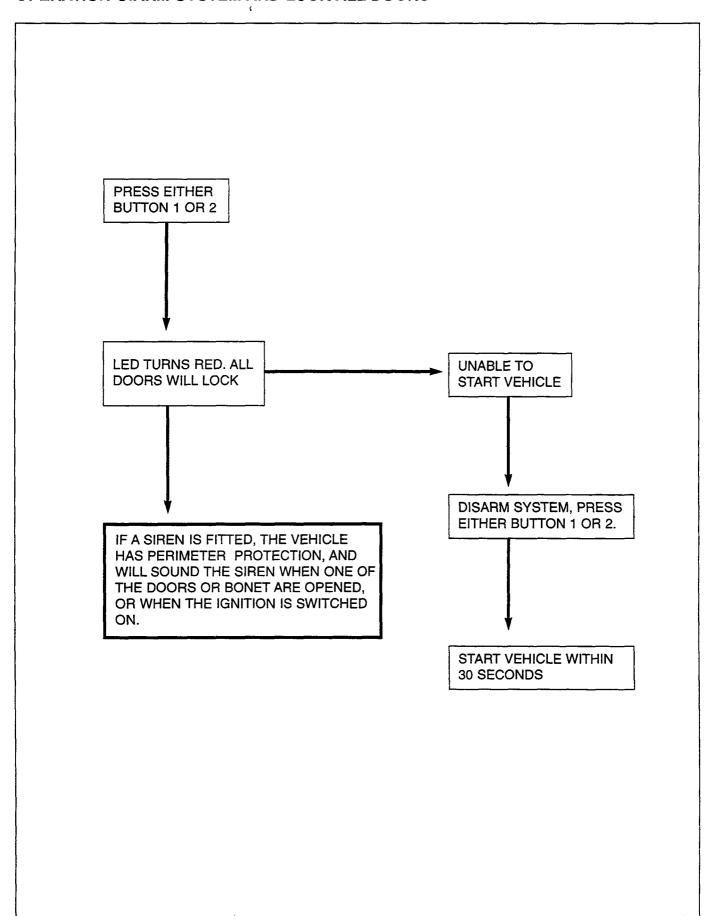
# VSS REMOTE CONTROL CHECKING PROCEDURE

- 1. Place vehicle so that a 1.5 m perimeter is available all around.
- Operate button one of transmitter (TX) so that all doors lock. If there is no response from the vehicle.
   (Doors lock/indicators flash), synchronise TX as fol lows:-
- 3. Stand at various points along 1.5 m perimeter to very TX range. (Refer SH 7 and 7).

# **V.S.S. REMOTE CONTROL OPERATIONS**



# **OPERATION C:ARM SYSTEM AND LOCK ALL DOORS**



# **VSS IMMOBILISER**

### INTRODUCTION

Your Isuzu is factory fitted with a vehicle security system (VSS) that automatically immobilises the vehicle when the ignition is switched off. The vehicle may be mobilised by using the jackplug or remote key supplied. Systems using jackplug keys can be upgraded to use remote keys. Alarm functions and many other features can be added by your local dealer. For upgrade information please contact your dealer.

A status indicator light is mounted on the dashboard. On remote controlled systems, a red light indicates that the system is immobilised and armed, whilst an orange light indicates that the vehicle is only immobilised on jackplug systems a red light indicates that the vehicle is immobilised. An extinguished light indicates that the vehicle may be entered and started.

No service override is available on vehicles manufactured after May 1996.

# **OPERATION OF JACKPLUG SYSTEM**

Mobilising the vehicle: The status light will be red when the vehicle is in the immobilised state.

Insert the jackplug key momentarily into the socket, situated below the light, while the ignition is switched off. The status light will be extinguished for 30 seconds during which the vehicle may be started.

### Note:

For simple operation of the system refer flow chart A

# IMMOBILISING THE VEHICLE

The vehicle will automatically be immobilised 30 seconds after the ignition is switched off. This condition is indicated by a red status light

# OPERATION OF THE REMOTE CONTROL SYSTEM

Mobilising the vehicle and disarming the alarm: The status light will be orange when the vehicle is in the immobilised state or red if the alarm is armed. Press the remote key's left button (dimple) once to unlock the driver's door or the right to lock all doors on vehicle fitted with central locking. This will disarm and mobilise the vehicle. Flash the indicators once, turn the interior

dome light on for 30 seconds and extinguish the status light for 30 seconds during which time the vehicle may be entered and started.

### Note:

- 1. For simple operation of system refer flow chart B.
- 2. If remote key failure is experienced entry into vehicle may be gained by means of the ignition key

# Operation

Insert key into barrel & turn key to the left which will open all doors. (To close all doors, turn key to the right).

# OPERATION FROM INSIDE OF VEHICLE USING LOCKING KNOB

Press driver's door locking knob and all doors will lock. (To open all doors lift driver's door locking knob.)

# IMMOBILISING THE VEHICLE AND ARMING THE ALARM

The vehicle will automatically be immobilised 30 seconds after the ignition is switched off. This condition is indicated by the status light turning orange. The alarm may be armed and the doors can be locked, on systems fitted with central door locking, by pressing any button on the remote key. The status light will turn red and the indicators will flash twice.

### Note:

For simple operation of system refer flow chart C.

# **VSS IMMOBILISER**

# THINGS TO REMEMBER ABOUT YOUR REMOTE KEYS

Remote keys will operate correctly only when you are close to your vehicle.

Pressing a key's button in for more than one second does not improve operation. The duration of transmission is determined electronically and not by the amount of times the button is pressed.

Press once and let go for best results.

Replace batteries every 12 months with Renata R393 or equivalent.

# LOSS OF SYNCHRONISATION

It will not be possible to arm or disarm the alarm if synchronisation is lost. This will happen if:

- a) A key's button is pressed more that 64 times while out of the system's operating range.
- an attempt is made to re-synchronise when not within the normal operating range.
- c) A key's batteries are replaced.

### SYNCHRONISATION

Synchronise the key be pressing both buttons until the key's red light stops flashing. The vehicle's indicators will turn on for 3 seconds if synchronisation has taken place. Ensure that you are within one metre from the driver's door.

# REMOTE KEY REPLACEMENT AND REPAIRS

Your Delta dealer has the necessary computerised test equipment and has been trained to analyse and rectify any problem in the unlikely event of a malfunction or failure. He can replace a lost key as long as you have one working key available. It will, for security reasons, be necessary to replace the complete security system if all keys are lost. The system supports only two keys.

# **VSS IMMOBILISER - JACK - PLUG KEY**

To start the vehicle, insert the Jack Plug Key (Item 1) in the socket (Item 2). Remove the jack Ply Key once the red indicator (Item 3) is off. Start the vehicle within thirty seconds.

### Note:

Should you not start the vehicle within thirty seconds, the red indicator will light up again.

Insert the Jack Plug Key in the socket and remove when the red indicator is off.

The red indicator will light up after a thirty second period once the ignition is switched off.

# CONNECTOR LIST

No.	Connector face	No.	Connector face
B-1		B-11	
	1 2 3 4 5 6		1 2 2
B-2	F 3 1 1 2 3 L	B-12	1 2 3 7
B-3	1 2 2	B-13	1 2 3 4 5 6
B-4	NOT USED	B-14	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
B-5	1 2 3 4 5 6	B-15	1 2 3 4 5 6
B-6	NOT USED	B-16	02 . B 05 5 7 8
B-7		B-17	NOT USED
B-8	2 3 4	B-18	NOT USED
B-9		B-19	1 2
B-10	1 2 3 4	B-20	2

No.	Connector face	No.	Connector face
B-21		B-31	
			_
B-22		B-32	
			NOT USED
B-23		B-33	Æ
	1 2 3 4 5 6 7		123
B-24		B-99	
	1 2 3 4 5 0 7 9 9		
B-25		B-50	uxh \exists
	NOT USED		1 2 2
B-26		B-34	
	1 2 3 4 5 6 7 8 9 10		[12]   3  45   67   8
B-27			
	NOT USED		
B-28			
B-29			
	1 2 3 4		
B-30			
	1 2 3 4		

- N-	Company		
No.	Connector face	No.	Connector face
			1 2
C-2		C-12	NOT USED
C-3	1 2 3 4 5 6 7 8	C-13	NOT USED
C-4	1 2 3 4 5 6	C-14	NOT USED
C-5		C-15	
C-6		C-16	NOT USED
C-7	2	C-17	[] [2]
C-8	NOT USED	C-18	
C-9	NOT USED	C-19	2 3
C-10	1 2	C-20	

Alc	Company	1	
No. C-21	Connector face	No. C-37	Connector face
	1		1 2 3
C-22		C-38	
C-23	NOT USED	C-39 (LHD)	
C-24		C-39 (RHD)	
C-25		C-40	112
C-26	2 3	C-41	4 3 2 1 8 7 6 5 5 6 7 8
C-27		C-42	16
C-28 \ C-34	NOT USED	C-43	654 321 14131211 10987 78910 111121314
C-35	1-2	C-44	1 2
C-36		C-45	

,						
No.	Connector face	No.	Connector face			
C-46	12 3	C-52				
C-47		C-53 \ C-57	NOT USED			
C-47	(GASOLINE)	C-58	2 1 1 2 3 4			
C-48	(GASOLINE)	C-59	NOT USED			
C-48	(4JA1)	C-60				
C-48	(4JA1 FOR SOUTH AFRICA)	C-60	(CHINA)			
C-48	(4JB1)	C-61				
C-49		C-62				
C-50	NOT USED	C-63	NOT USED			
C-51		C-64	NOT USED			

No.	Connector face	No.	Connector face
C-65		C-74	
C-66		C-75	3 2 1 6 P 5 P 4
C-66	1 2 1 4 3 (CHINA)	C-76	1 2
C-67	NOT USED	C-77	120
C-68		C-78	1 2 3 4 5 8 7
C-69	NOT USED	C-78	(4ZD1 WITH CATALYSIS CONTROL)
C-70		C-79	
C-71		C-80	1 2 3 4 5 6
C-72	1 2	C-81	===
C-73	12	C-82	1 2 1 4 3

No.	Connector face	No.		Connector face
C-83	[			
C-84				2
	1 2 3		1 2	2
C-85	1 2 1 4 3			
C-86	A1 22 A3 A4 A5 A5 A5 A5 A5 A5 A5 A5 A5 A5 A5 A5 A5		=====	
C-87	12		=======================================	
C-88	NOT USED		=	
C-89	NOT USED			
C-90	3 2 1			
C-91	1 2 3 4			
	•			

No.	Connector face	No.	Connector face
D-1		D-11	21
D-2	3 2 1	D-12	1 2 3 4 5 6
D-3	1. 2	D-13	1 2
D-4	123	D-14	1 2 3 4
D-5	1 2 3 4 5 6 7 8 9 10	D-15	21
D-6	21	D-16	1 2 2 3 4 5 6 1
D-7	123	D-17	[] [2]
D-8	2	D-18	1 2 3 4
D-9	1 2 3 4		
D-10	1 2 3 4 5 6 7 8 9 10		

No.	Connector face	No.	Connector face
E-1	(DIESEL)	E-10	
E-1		E-11	
	(GASOLINE WITH MPI)		1 2 3 4
E-2	8	E-12	
			N 112 X
E-3		E-13	
			X TIZX
E-4		E-14	_
E-5		E-15	
E-6	_	E-16	
			1 2 3
E-7	_	E-17	
	X 1,2 X		NOT USED
E-8		E-18	
	WILZW		NOT USED
E-9		E-19	
	WIIZW		

No.	Connect	or face	No.	Connector	face
E-20	00.01000		E-47		
F-35	NOT USED			NOT USED	
E-36	1 2	1 2	E-48	NOT USED	
E-37			E-49	===	
E-38 \$ E-40	NOT USED		E-50		
E-41					:
E-42					
E-43		=======================================			
E-44					
E-45					
E-46					

		1	
No.	Connector face	No.	Connector face
	123		
F-2	12		
F-3			

No.	No. Connector face No. Connector face				
H-1			H-8 (LHD)	1 2 3 10 4 5 6 7 8 8 10 11 12 13 14 15 16 17 18 19 20	6 5 4 10 3 2 1 13 12 11 9 8 7 20 19 18 17 16 15 14
H-2	1 2	1 2	H-8 (RHD)	1 2 3 A 5 6 7 8 9 TO	4 3 2 1 10 9 8 7 6 5
H-3	NOT USED		H-9	1 2 3 4 5 6 7 8 9 101112 1314 151617 181920	43 2 1 121110 9 8 7 6 5 2019181716151413
H-4	1 2 3 4 5 6 7 8 8 10 111 12 13 14	4 3 2 1 9 0 7 6 5 14 13 12 11 10 16 15	H-10	1121 (WITHOUT POWER WINDO	UZ 15 W AND POWER DOOR LOCK)
H-5	1 2 3 4 5 6 7 8 (4ZC1 A	4 3 2 1 8 7 6 5 ND 4ZD1)	H-10	1 2 3 4 5 6 7 8 9 101 11213 (WITH POWER WINDOW	3 21 8 7 6 5 4 13121109 AND POWER DOOR LOCK)
			H-11	1 2	1 2
H-5	1 2 3 4 5 6 (4ZE1)	3 2 1 6 5 4	H-12	1 2	21
H-71	1 2 3 4 5 6 7 8 9 10 111213141516 171813202122	rd 9   8   7   6   12   1   1   1   1   1   1   1   1	H-13	1121 (WITHOUT POWER WINDO	U AND POWER DOOR LOCK)
			H-13	1 2 3 4 5 6 7 8 9 10 (WITH POWER WINDOW	43 21 1098765 AND POWER DOOR LOCK)
H-7 (RHD)	1 2 2 3 4 5 6	2 1 1 6 5 4 3	H-14	1 2 3 4 5 6 7 8	3 F 2 1 8 7 6 5 4

No.	Connector face	No.	Connector face
H-15	2 345678 910172314	H-72	321
H-16	12 B 15678	H-53	
H-17	1 2 3 4 5 6	H-73	
H-18	123	H-77	12 3 3 1 1 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1
H-19	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	H-76	
H-20	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	H-31	
H-21			
H-51			
H-52			
H-72			

No.	Connector face	No.	Connector face
L-1	Competer race	140.	Connector race
L-2			
L-3			
L-4			
L-5			
L-6			
L-7			
L-8			
L-9			

No.	Connector face		No.	Connector face	
M-1			M-13		
M-2			M-14		
M-3	=527				
M-4		=			
M-5 { M-7	NOT USED				
M-8	=				
e-M					
M-10					
M-11					
M-12					

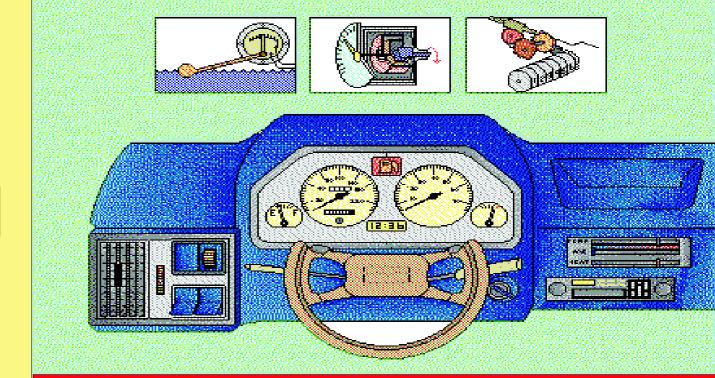
No.	Connector face	No.	Connector face		
P-1		P-9	NOT USED		
P-2		P-10			
P-3	(DIESEL)				
P-3	(GASOLINE)				
P-4			•		
	(DIESEL)				
P-4					
P-5	(GASOLINE)				
P-6	NOT USED				
P-7					
P-8	NOT USED				

T					
No.	Connector face	No.	Connector face		
R-2	NOT USED				
R-3	12				
R-4					
R-5	NOT USED				
R-6	=======================================				

No.	Connector face	No.	Connector face
T-1	123456		
T-2	NOT USED	,	•
T-3			
T-4	NOT USED		
T-5	NOT USED		
T-6	123456		



Radio
Driving Lamps



# TF 140 Accessories

# SECTION 9 ACCESSORIES

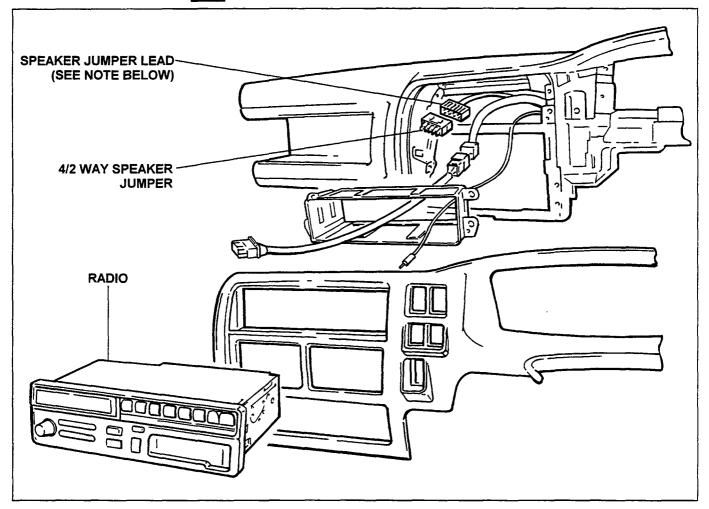
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# RADIO 4/2 WAY SPEAKER JUMPER



# **INSTALLATION**



The appropriate speaker jumper (20R 4 way) is to be fitted to the jumper lead for radio aftermarket fitment.

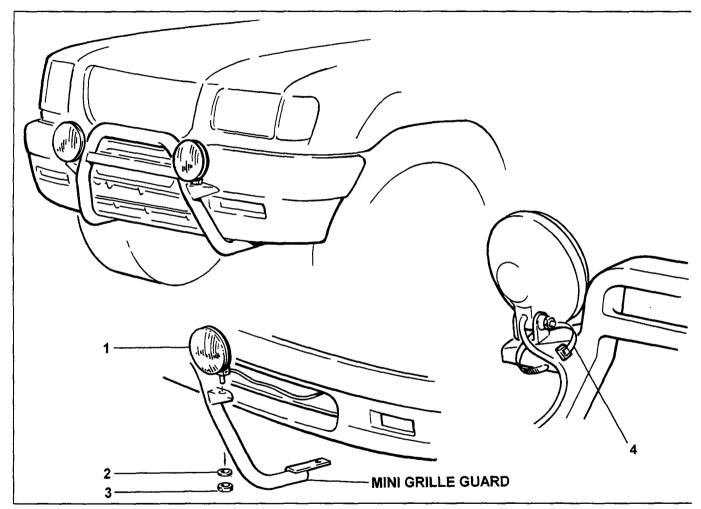
Note\*: Jumper fitted to models prior to September 1997.

# DRIVING LIGHTS (Mounted to mini grille guard)





# **REMOVAL AND INSTALLATION**



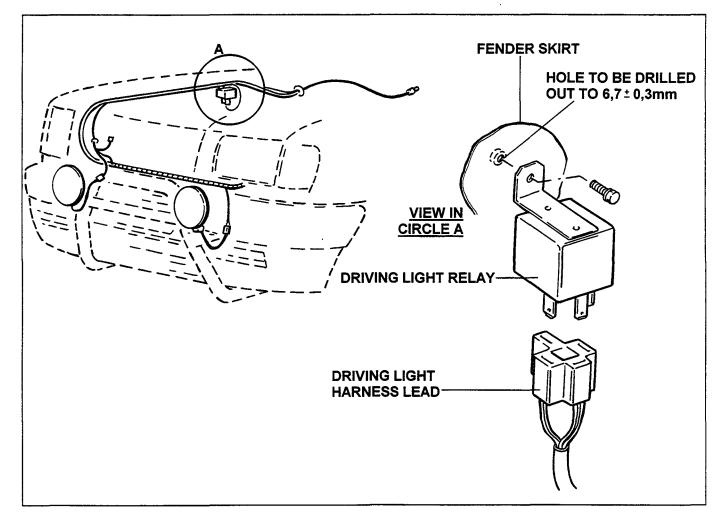
# **Removal Steps**

- 4. Cable tie
- ▲ 3. Nut
  - 2. Washer
  - 1. Driving light

# **Installation Steps**

- 1. Driving light
- 2. Washer
- ▲ 3. Nut
  - 4. Cable tie

Note: The cable tie must be fitted after the driving lamps have been focused/adjusted.



The driving light relay is to be mounted on the fender skirt as shown and the harness lead connected.











Servicing

Windshied

Doors

Front Seat

Seat Belts



# KB TF 140 Cab

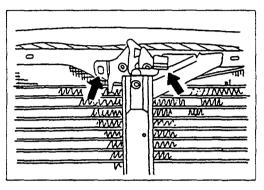


# SECTION 10 CAB

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Instrument Panel	10 – 25
Driver's Foot rest	10 – 37
Console Box	10 – 38
Headlining	10 – 39
Front Seat	10 – 42
Front and Rear Seat Belts	10 – 50
Vehicle Security System	10 - 51
Rear Seat Back Rest	10 – 53
Body Side Mouldings	10 - 54
Mud flaps	10 – 55
Roll bar	10 – 57
Grille Guard	10 – 58
Wheel Arch Mouldings	10 – 60
Stone Guard	10 – 61

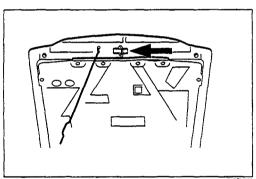
# **SERVICING**





#### **Engine Hood Lock**

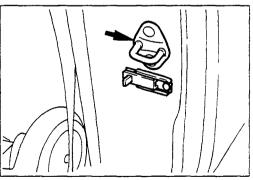
Align the engine hood lock with the installation holes.





#### **Engine Hood Striker**

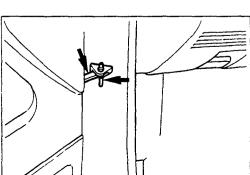
Apply a light coat of grease to the striker.





#### **Door Striker**

Apply a light coat of grease to the striker.





#### Door Checker Arm and Pin

Apply a light coat of grease to the checker arm and pin.

# WINDSHIELD AND BACK LIGHT GLASSES

#### **GENERAL DESCRIPTION**

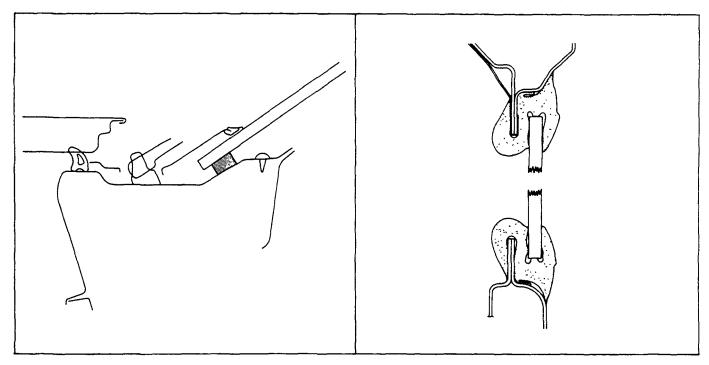
This vehicle uses two types of safety glass: (1) laminated safety plate, for the windshield, and (2) solid tempered safety plate, for the back glass.

The windshield glass is one-piece and is directly retained in the windshield opening by the adhesive.

When replacing a cracked windshield glass, it is very important that the cause of the glass breakage be determined and the condition corrected before a new glass is installed. Otherwise, it is possible that a small obstruction or high spot somewhere around the windshield opening will continue to crack or break the newly installed windshield. This is especially true when the strain on the glass caused by this obstruction is increased by such conditions as wind pressures, extremes of temperature, motion of the vehicle, etc. The procedure for removal of the windshield applies to the complete windshield assembly.

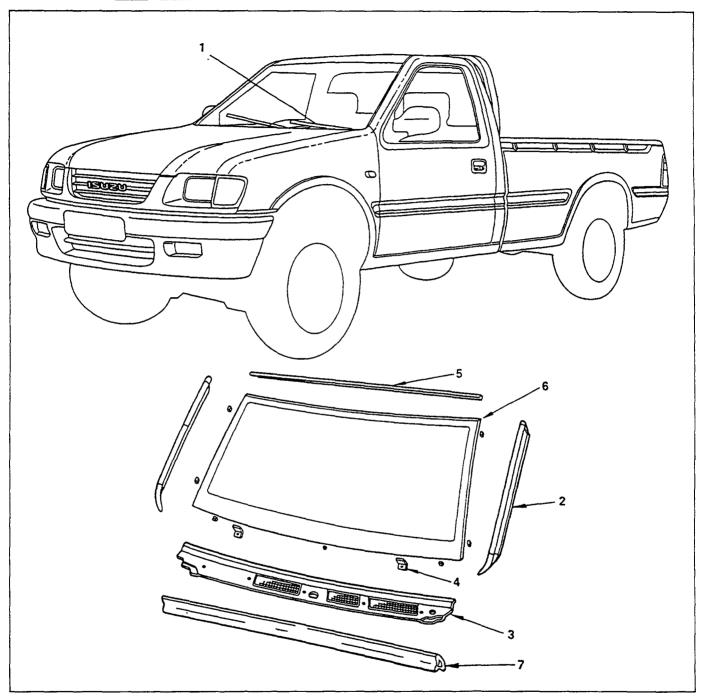
#### WINDSHIELD GLASS

#### **BACK LIGHT GLASS**





# **REMOVAL AND INSTALLATION**

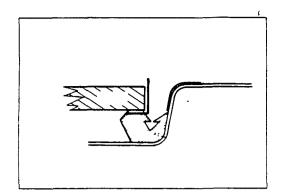


## **Removal Steps**

- 1. Wiper arm assembly
- 2. Side moulding
- 3. Vent cowl cover
- 4. Windshield stopper
- Upper moulding
- 6. Windshield glass7. Engine hood rear seal

#### **Installation Steps**

- ▲ 7. Engine hood rear seal
- ▲ 6. Windshield glass
- ▲ 5. Upper moulding
- ▲ 4. Windshield stopper
  - 3. Vent cowl cover
- 2. Side moulding
  - 1. Wiper arm assembly



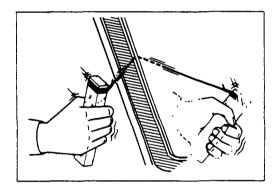


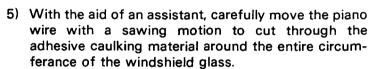
#### Important Operations - Removal

#### 6. Windshield Glass

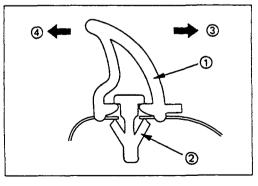
Remove the windshield glass, carefully following the steps listed below:

- 1) Use a knife to cut through part of the adhesive caulking material.
- 2) Secure one end of a piece of steel piano wire (0.02 inches in diameter) to a piece of wood that can serve as a handle.
- Use a pair of needle nose pliers to insert the other end of the piano wire through the adhesive caulking material at the edge of the windshield glass.
- 4) Secure the other end of the piano wire to another piece of wood.





- 6) Lift the windshield from the body.
- 7) Clean any remaining adhesive caulking material from the area of the body which holds the windshield.
- 8) Use a soft rag and unleaded gasoline to wipe off any adhesive remaining on the windshield glass.





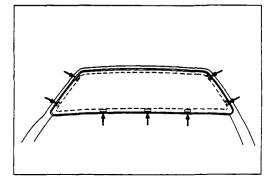
#### Important Operations — Installation



#### 7. Engine Hood Rear Seal

Install the engine hood rear seal as shown in the illustration.

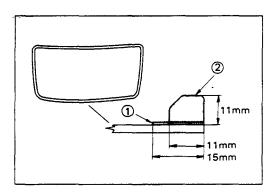
- ①: Seal
- (<u>2</u>): Clip
- ③: Rear (windshield glass side)
- 4): Front





#### 6. Windshield Glass

- 1) Clean the windshield glass bonding surface.
- 2) Use a soft rag and unleaded gasoline to wipe off any adhesive remaining on the body.
- 3) Mount the body window glass as shown in the illustration. Attach spacers at seven (7) locations.

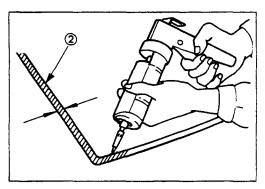




4) Apply primer ① #435-95 or equivalent to the body side bonding surface. The primer should extend 25 mm (1 in.).

Apply primer #435-40 or equivalent to the windshield glass side bonding surface.

The primer should extend 15 mm (0.6 in.) from end of the glass.





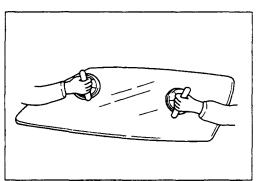
Apply the window glass sealing adhesive 2.

If you are using an air gun, air pressure should be maintained at 147 - 294 kpa.

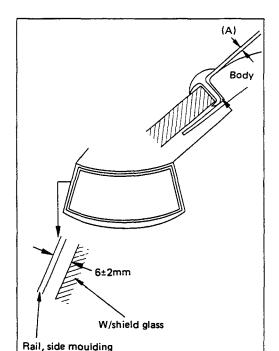
#### Note:

Open time (1 min. or more) should be set after application of the primer.

Bonding shall be done within 5 minutes after the sealer has been applied.



Adjust the setting of the windshield glass with suction discs.



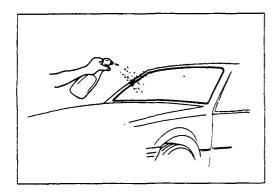
The center of the windshield glass should be in alignment with the center of the windshield glass opening.

The clearance between body and upper moulding should be within 0.5 mm (A).

Both of the clearance for RH and LH should be same. (6 mm  $\pm$  2 mm)

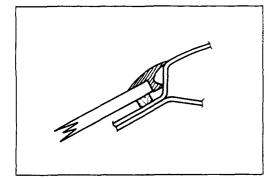
#### Note:

It is a good idea to perform the windshield installation procedure from beginning to end without pausing. If you allow time to elapse between steps, excessive amounts of adhesive may be extruded from around the windshield.

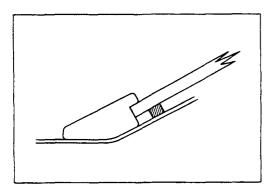


#### 5. Upper Moulding

1) Before installing the windshield moulding (at the upper part of the windshield), spray hot water at a temperature of about 140°F (60°C) onto the windshield glass and the adhesive. This will cause curing.

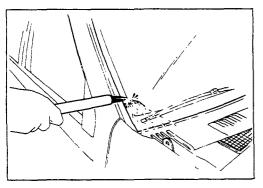


2) Install the upper moulding as soon as hot water has been applied. Using a roller push moulding in until it bottoms.



#### 4. Windshield Stopper

Do this immediately after completing the gap adjustment.



# 2. Side Moulding

Use unleaded gasoline and a soft cloth to wipe away any excess adhesive.

Cure the bonding at a temperature of  $68^{\circ} - 86^{\circ}F$  (20° - 30°C) for twenty-four hours.

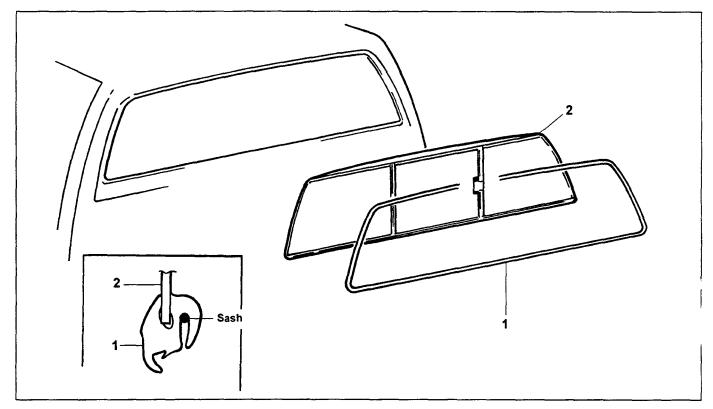
Check that the windshield does not leak water.

# **SLIDING REAR WINDOW**





# **REMOVAL AND INSTALLATION**



# **Removal Steps**

- Remove weatherstrip by pushing the lip located on the inside of cab flange opening towards the outside of cab.
- By using hand pressure push the sliding window assembly towards outside of vehicle.

## **Installation Steps**

- 1. Assemble weatherstrip (1) to sliding window (2).
- Fit cord sash as shown in sketch and by pulling the cord towards the inside of the vehicle all round the flange. A second person is to push the assembly inwards.

#### Note:

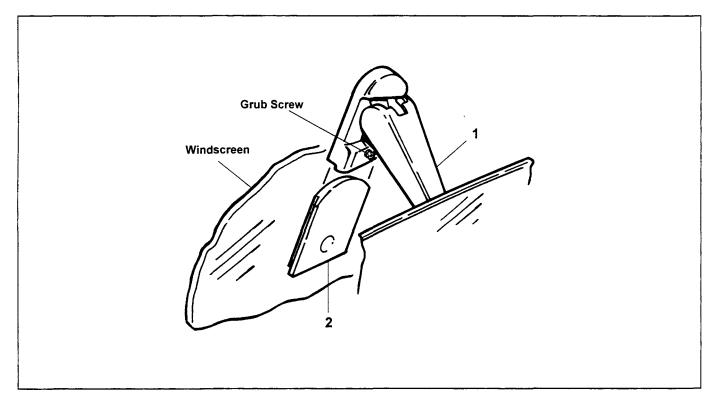
A rubber mallet can also be used to tap the assembly into position from the outside. This removal/installation procedure is a two man operation.

# INTERIOR MIRROR





# **REMOVAL AND INSTALLATION**



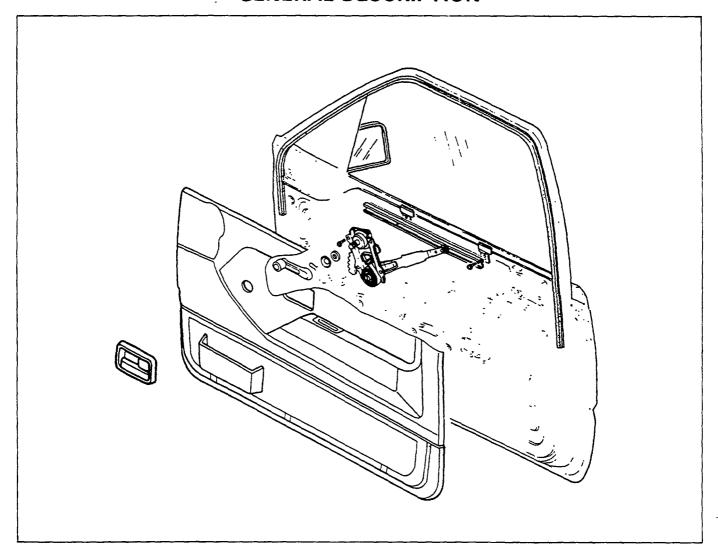
### **Removal Steps**

 Hold mirror assembly (1) firmly and using a 2 mm Alan key loosen grub screw sufficiently to slide it out from the base plate (2) on the windshield.

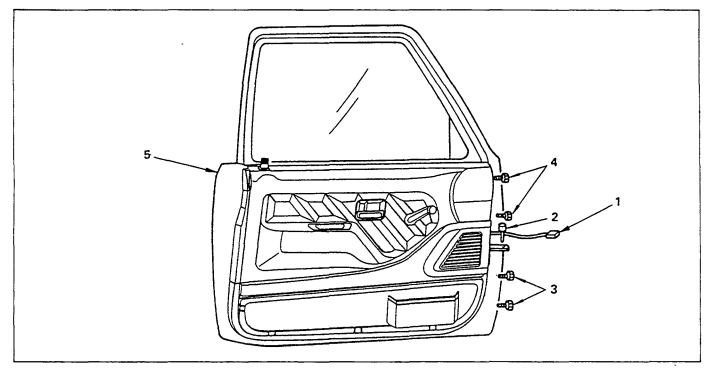
#### **Installation Steps**

 Hold mirror assembly firmly and slide into base plate. Using the 2 mm Alan key hand tighten the grub screw to avoid any play in mirror base.

# DOORS GENERAL DESCRIPTION



# **REMOVAL AND INSTALLATION**

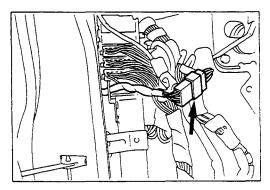


#### **Removal Steps**

- 1. Door harness
- 2. Checker pin
- 3. Lower hinge
  - 4. Upper hinge
  - 5. Door assembly

### Installation Steps

- 5. Door assembly
- 4. Upper hinge
- 3. Lower hinge
- 2. Checker pin
- 1. Door harness



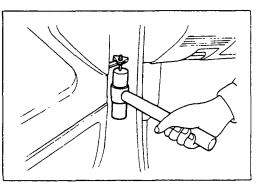


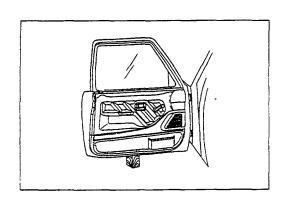
#### Important Operation — Removal

#### 1. Door Harness

Disconnect the door harness.

# 2. Checker Pin



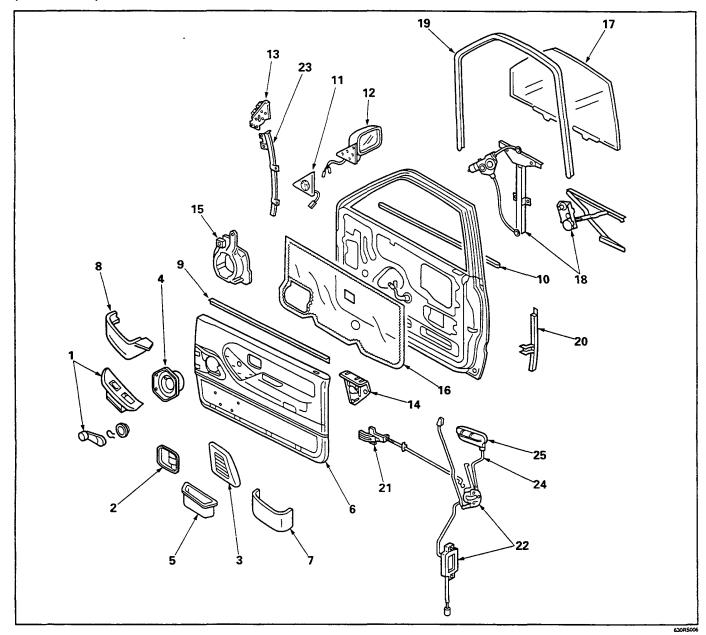


#### 3. Lower Hinge

Position a wood block under the door for protection and support the door assembly with hands at Removal or Installation.

# +++ DISASSEMBLY

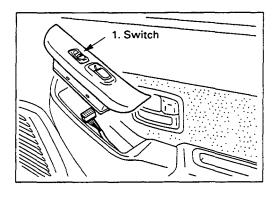
#### (Front Door)



# **Disassembly Steps**

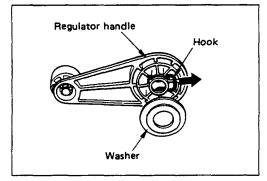
- ▲ 1. Power window switch/Window regulator handle
- ▲ 2. Bezel
- ▲ 3. Speaker grill
- ▲ 4. Speaker assembly
- ▲ 5. Door pull case
- ▲ 6. Door trim pad
- ▲ 7. Door pocket
- ▲ 8. Power window box
- ▲ 9. Inner waste seal
- ▲ 10. Outer waste seai
- ▲ 11. Door mirror cover
- ▲ 12. Door mirror assembly

- ▲ 13. Door mirror bracket
- ▲ 14. Bracket
- ▲ 15. Speaker box
- ▲ 16. Water-proof sheet
- ▲ 17. Window glass
- ▲ 18. Window regulator/Power window motor
- ▲ 19. Glass run
- ▲ 20. Glass run rear channel
- ▲ 21. Inside lever
- ▲ 22. Door lock assembly/Door lock actuator
- ▲ 23. Glass run front channel
- ▲ 24. Door lock cylinder
- ▲ 25. Outside handle

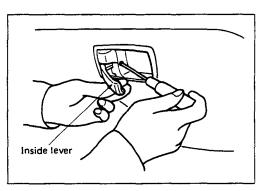


# **Important Operations**

- 1. Power Window Switch/Window Regulator Handle
  - Prise out the power window switch and remove the connectors.

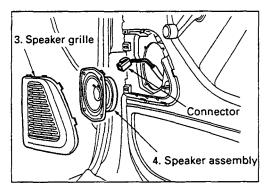


• To remove the regulator handle, remove the clip at the root of the handle by using wire.



#### 2. Bezel

 Remove the screw while pulling the inside lever toward you.

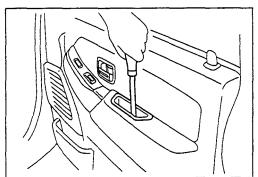


#### 3. Speaker Grill

Pull out from the front to disengage the clips.

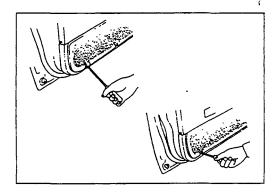
#### 4. Speaker Assembly

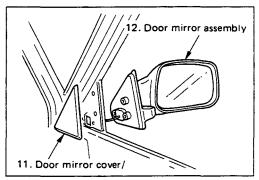
 Remove 4 screws and disconnect the speaker harness connector.

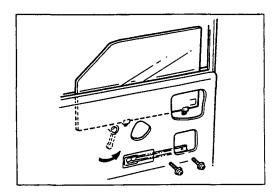


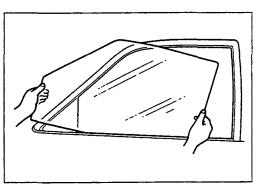
#### 5. Door Pull Case

Remove the screw at the bottom of the case.









#### 6. Door Trim Pad

 Remove the cover bottom of the trim pad (4 pcs.), then remove the screws.

#### 7. Door Pocket

- 8. Power Window Box
- 9. Inner Waste Seal
- 10. Outer Waste Seal

#### 11. Door Mirror Cover

• Pull out the upper clip, and then take out the catch at the lower section.

#### 12. Door Mirror Assembly

Remove 3 fixing bolts and then remove the connector.

#### 13. Door Mirror Bracket

 Remove 2 bolts at the lower section, and then remove 2 screws in the weather strip.

#### 14. Bracket

#### 15. Speaker Box Spacer

· Remove 3 fixing bolts.

#### 16. Water Proof Sheet

 Take care not to damage the sheet when peeling if off.

#### 17. Window Glass

 Remove 2 screws through the access hole and pull out the window glass upward.

#### 18. Window Regulator/Power Window Motor

Disconnect the power window motor connector.

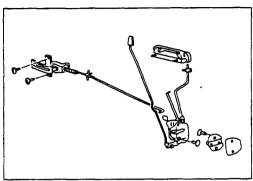
#### 19. Glass Run

 Pull it out of the door piller of the channel (front/rear).

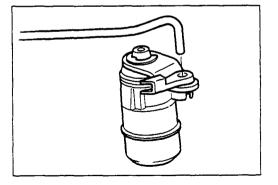
#### 20. Glass Run Rear Channel

Remove 2 screws.

#### 21. Inside Lever







#### 22. Door Lock Assembly/Door Lock Actuator

Disconnect the linkage with the outside handle, the inside lever and the lock cylinder.

#### 23. Glass Run Front Channel

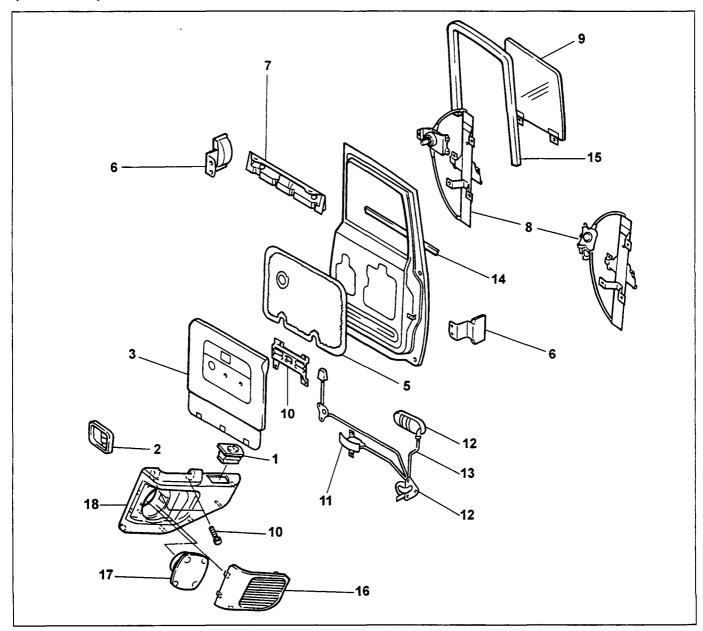
#### 24. Door Lock Cylinder

Remove the door lock cylinder by applying finger pressure from inside while depressing the retaining clip.

#### 25. Outside Handle

# DISASSEMBLY

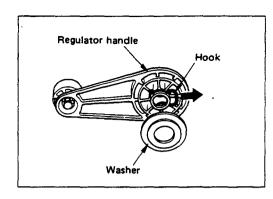
# (Rear Door)



# **Disassembly Steps**

- ▲ 1. Power window switch/window regulator handle
- ▲ 2. Bezel
  - 3. Cover, lower plate fixed
- 4. Door trim pad
  - 5. Water proof sheet
  - 6. Glass guide
  - 7. Upper cover
- 8. Window regulator/power window motor

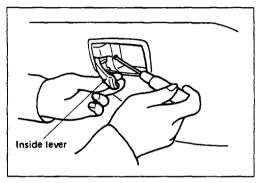
- 9. Window glass
  - 10. Bracket
  - 11. Inside lever
  - 12. Outside handle
- ▲ 13. Door lock cylinder
  - 14. Outer waste seal
  - 15. Glass run
  - 16. Speaker Grille
  - 17. Speaker
  - 18. Arm rest assembly





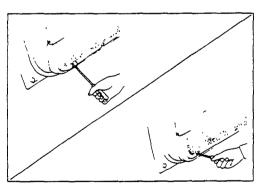
# **Important Operations**

- 1. Window Regulator Handle
  - To remove the regulator handle, remove the clip at the root of the handle by using wire.



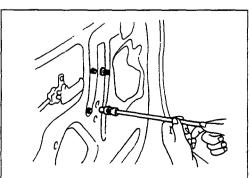
#### 2. Bezel

 Remove the screw while pulling the inside lever toward you.



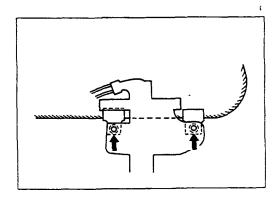
#### 4. Door Trim Pad

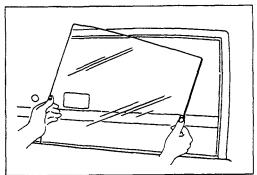
 Remove the cover bottom of the trim pad (3 pcs), then remove the screws.

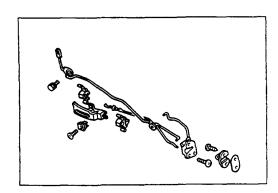


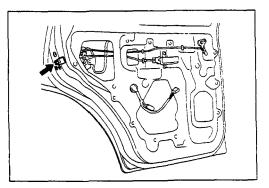
## 8. Window Regulator

• Remove the 4 screws holding the regulator.









#### 9. Window Glass

 First, align the height of regulator to the access hole. Remove 2 screws attaching bottom channel and regulator, then remove the glass.

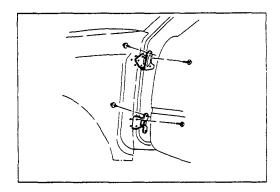
 Remove the window glass by tilting it as necessary.

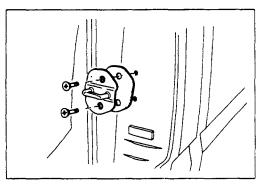
#### 13. Door Lock Assembly

 Disconnect the linkage from the door outside handle, inside lever and lock cylinder.
 Remove the 2 bolts holding the outside handle from inner side.

 Remove the 3 bolts holding the door lock assembly.

# ADJUSTMENT (FRONT AND REAR)





#### **Door Hinge**

Door alignment can be obtained by moving door hinges. Prior to adjustment, remove the fender and set the door

temporarily.

Loosen hinge to door bolts when adjusting steps between the door and body.

Loosen hinge to body bolts to adjust the clearance between the door and body.

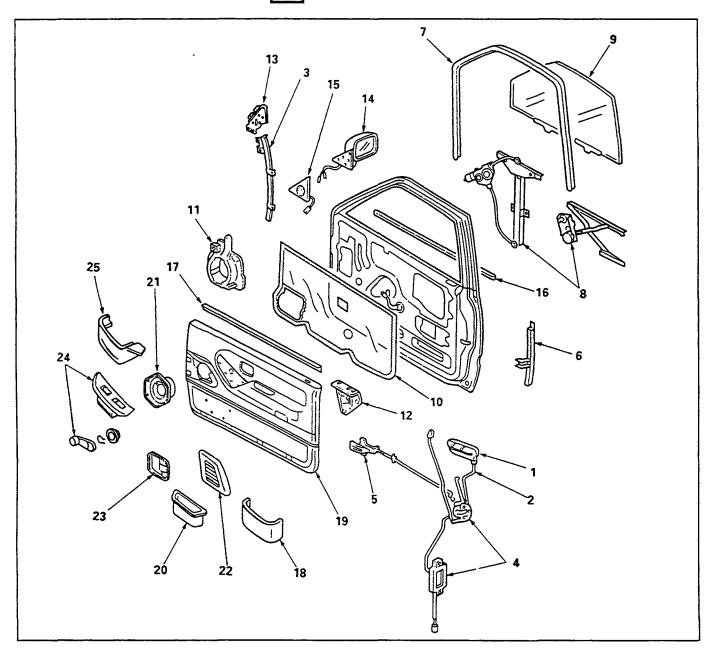
#### **Door Striker**

Loosen the striker screws and adjust the position of the striker by holding a piece of wood against the striker and tapping it with a hammer.

To obtain correct adjustment, move the position of the striker vertically so that the lower face of the dovetail becomes parallel to the striker.

Adjust the number of sheets to control engagement of the striker with the door latch. One or two sheets are generally used to obtain correct adjustment.

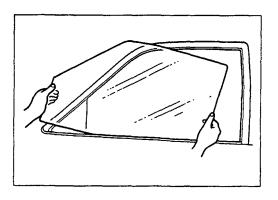
# REASSEMBLY



# **Reassembly Steps**

- 1. Outside handle
- 2. Door lock cylinder
- 3. Glass run front channel
- Door lock assembly/Door lock actuator
- 5. Inside lever
- 6. Glass run rear channel
- 7. Glass run
- 8. Window regulator/Power window motor
- ▲ 9. Window glass
- ▲ 10. Water proof sheet
  - 11. Speaker box spacer
  - 12. Bracket

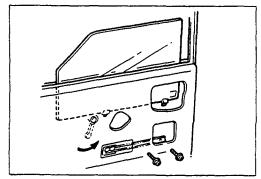
- 13. Door mirror bracket
- 14. Door mirror assembly
- 15. Door mirror cover
- 16. Outer waste seal
- 17. Inner waste seal
- 18. Door pocket
- 19. Door trim pad
- 20. Door pull case
- 21. Speaker assembly
- 22. Speaker grille
- 23. Bezel
- ▲ 24. Power window switch/Window regulator handle
  - 25. Power window box



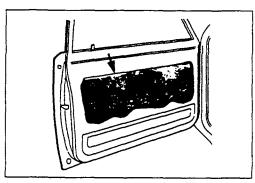


#### **Important Operations**

- 9. Window Glass
  - Insert the window glass into position by tilting it as necessay, then set it against the channel of the window regulator.

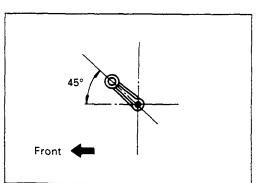


 Attach the window glass to the window regulator with the two screws.



#### 10. Water Proof Sheet

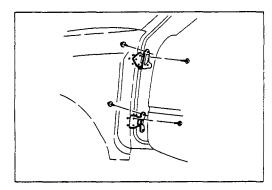
 Place the butyl tape on the door panel so as not to cover the drain hole.

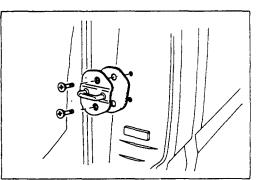


### 24. Regulator Handle

 Install the regulator handle as illustrated when closing the window glass.

# ADJUSTMENT (FRONT AND REAR)





#### **Door Hinge**

Door alignment can be obtained by moving door hinges. Prior to adjustment, remove the fender and set the door temporarily.

Loosen hinge to door bolts when adjusting steps between the door and body.

Loosen hinge to body bolts to adjust the clearance between the door and body.

#### **Door Striker**

Loosen the striker screws and adjust the position of the striker by holding a piece of wood against the striker and tapping it with a hammer.

To obtain correct adjustment, move the position of the striker vertically so that the lower face of the dovetail becomes parallel to the striker.

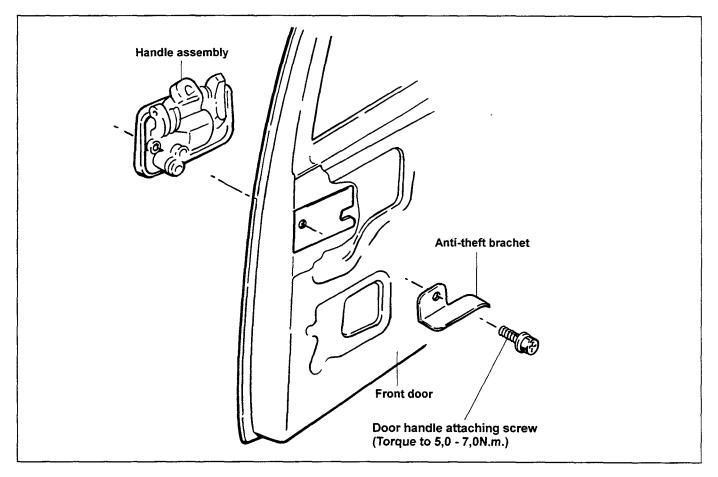
Adjust the number of sheets to control engagement of the striker with the door latch. One or two sheets are generally used to obtain correct adjustment.

# **BRACKET ANTI-THEFT**





# REMOVAL AND INSTALLATION



# **Removal Steps**

- Remove front door trim panel -Refer Section 10-13.
- 2. Remove existing rear most door handle attaching bolt.
- 3. Remove anti-theft bracket.

#### Installation

- Hold door handle in position on locating holes in door outer sheet metal panel.
- 2. Place anti-theft bracket on rear door handle locating hole.
- 3. Use door handle attaching screw to attach the anti-theft bracket.
- 4. Reassemble door trim panel and components.

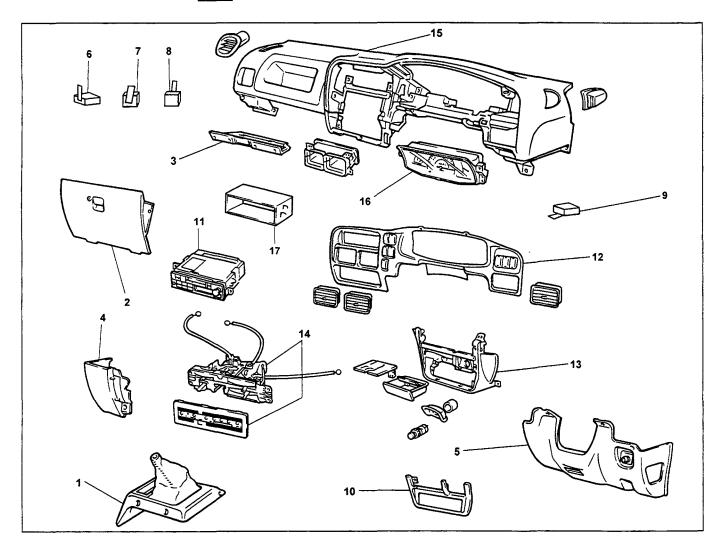
#### Note:

Care needs to be taken when removing/ installing, so that bracket/screw does not drop into the door assembly.

# **INSTRUMENT PANEL**

# **++**

# **REMOVAL**



# **Removal Steps**

- ▲ 1. Center console assembly
- ▲ 2. Glove box
- ▲ 3. Glover box cover
- ▲ 4. Instrument panel passenger lower cover assembly
- ▲ 5. Instrument panel driver lower cover assembly
  - 6. Warning buzzer
  - 7. CDL Interface unit
  - 8. Temperature controller

- 9. AM key module
- ▲ 10. Lower cluster assembly
  - 11. Radio assembly
- ▲ 12. Meter cluster assembly
- ▲ 13. Instrument panel lower center cover assembly
  - 14. Control lever assembly
  - 15. Instrument panel assembly
  - 16. Meter assembly
  - 17. Radio bracket

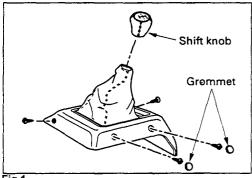


Fig.1

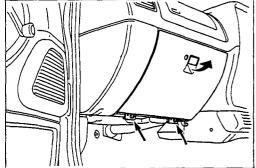


Fig.2

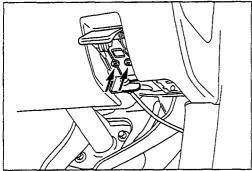


Fig.3

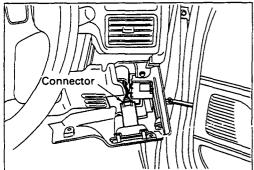
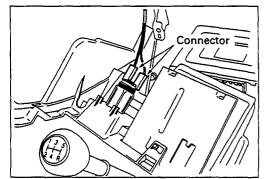


Fig.4



#### **Important Operations**

- 1. Center Console Assembly (Fig.1)
  - Remove shift knob and 2 fixing screws (front side).

Open the grommet and remove 2 fixing screws. (rear side).

#### 2. Glove Box (Fig.2)

• Remove 2 fixing screws and pulling the handle.

#### 3. Glove Box Cover

- · Remove 4 fixing screws and pull the cover toward you and remove the clips at 2 positions.
- 4. Instrument Panel Passenger Lower Cover Assembly
  - Remove 3 fixing screws and 1 clip.

### 5. Instrument Panel Driver Lower Cover Assembly (Fig.3)

Remove the engine hood opener 2 fixing screws and 6 fixing screws.

Disconnect the connector of the illumination. (Fig.4)

#### 10. Lower Cluster Assembly

Remove 3 fixing clips.

#### 12. Meter Cluster Assembly

Remove 3 fixing screws, 7 clips and switch connectors.

## 13. Instrument Panel Lower Center Cover Assembly (Fig.5)

Remove 7 fixing screws and disconnect the connector of the cigarette lighter.

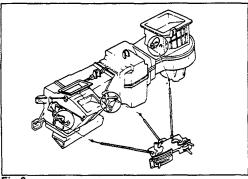


Fig.6

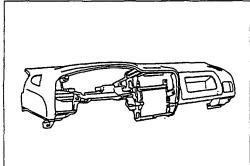


Fig.7

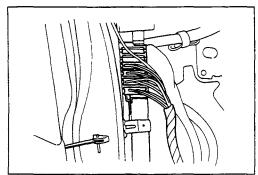


Fig.8

# 13. Control Lever Assembly (Fig.6)

- 1) Disconnect the control cable from heater unit and blower unit.
- 2) Remove the control lever assembly fixing screws.

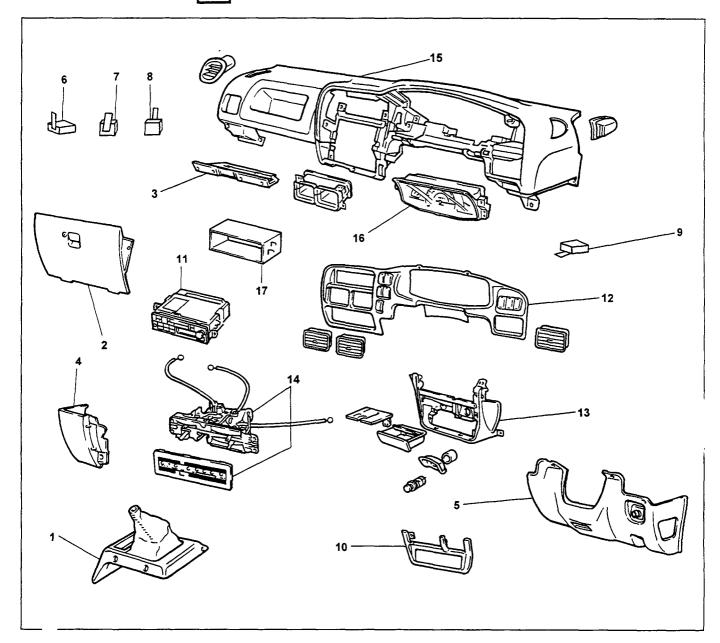
### 14. Instrument Panel (Fig.7)

1) Remove the instrument panel fixing nuts and bolts.

- 2) Disconnect the instrument harness on ECM. (Fig.8)
- 3) Remove the instrument panel.

# **+**

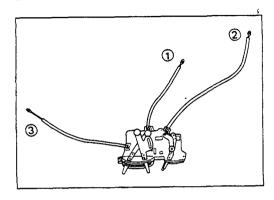
# **INSTALLATION**

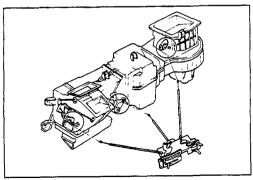


# **Installation Steps**

- 17. Radio bracket
- 16. Meter assembly
- 15. Instrument panel assembly
- ▲ 14. Control lever assembly
  - Instrument panel lower center cover assembly
  - 12. Meter cluster assembly
  - 11. Radio assembly
  - 10. Lower cluster assembly
  - 9. AM key module

- 8. Temperature controller
- 7. CDL Interface unit
- 6. Warning buzzer
- Instrument panel driver lower cover assembly
- 4. Instrument panel passenger lower cover assembly
- 3. Glove box cover
- 2. Glove box
- 1. Center console





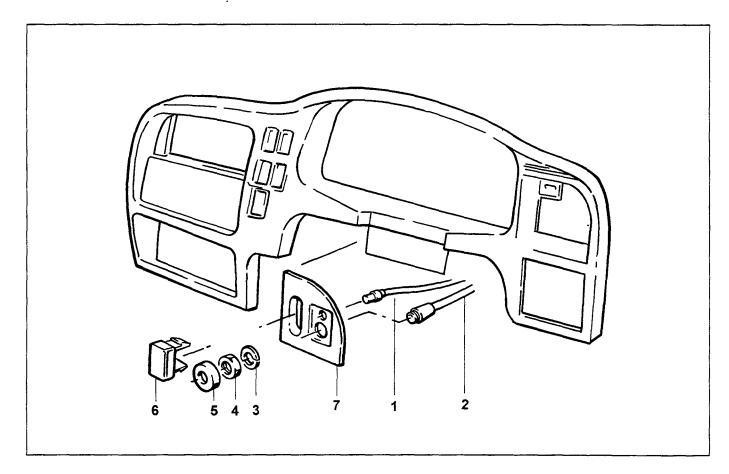
#### 14. Control Lever Assembly

- 1) Set the temperature control lever and the airsource select lever st the left-hand side end.
- 2) Set the air selector lever at the right-hand side end.
- 1: Temperature control cable.
- 2: Air source select cable.
- 3: Air selector.

3) Attach the cable, after the work 1) and 2) have been completed.

# **BEZEL - VEHICLE SECURITY SYSTEM**

# REMOVAL AND INSTALLATION



# **Installation Steps**

- 1. Light-emitting diode (led) lead
- 2. Jack plug lead
- 3. Washer
- 4. Nut
- 5. Grommet
- 6. Hole cover
- 7. Bezel VSS

# **Removal Steps**

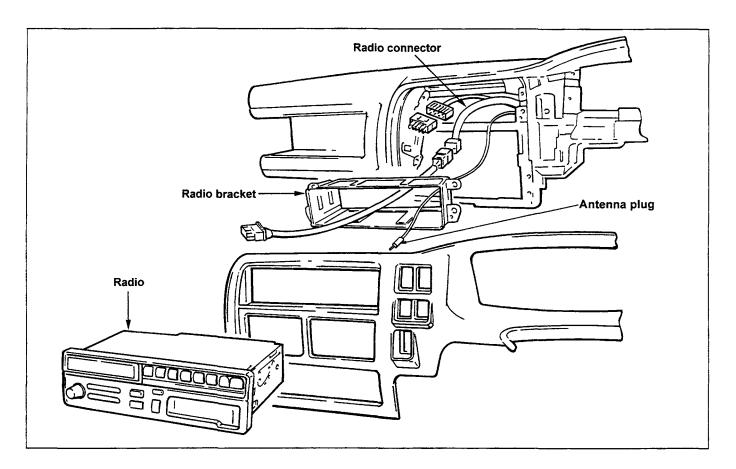
- 7. Bezel VSS
- 6. Hole cover
- 5. Grommet
- 4. Nut
- 3. Washer
- 2. Jack plug lead
- 1. Led lead

# **RADIO**





# **→**← REMOVAL AND INSTALLATION



# Removal Steps SANYO FXR 100 LD/FXR 315

- Insert an unlock lever (supplied with radio) into the slot on each side of the radio until it clicks.
  - Do not insert the levers upside down.
  - Press levers downward, then pull levers to remove the radio.
  - Unplug the radio connector and antenna cable.

## **Installation Steps**

- Plug in the radio connector and antenna cable.
   Make sure that the antenna cable plug goes in all the way.
- 2. Guide the cables carefully into the aperture, and slide the radio into position until it clicks.



# Removal Steps SANYO FXR 713 RDS

- Remove radio face.
- Insert unlock rods (supplied with radio) into the holes on each side of the radio until they click.
  - Pull levers to remove the radio.
  - Unplug the radio connector and antenna cable.

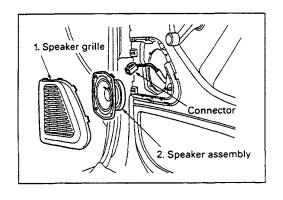


# **Installation Steps**

- Plug in the radio connector and antenna cable.
   Make sure that the antenna cable plug goes in all the way.
- Guide the cables carefully into the aperture, and slide the radio into position until it clicks.

# FRONT SPEAKER

# REMOVAL AND INSTALLATION





## Removal Steps

- 1. Speaker Grille
  - Pull the grille to release the clips.
- 2. Speaker
  - · Remove four screws.
  - · Disconnect the connector.



### **Installation Steps**

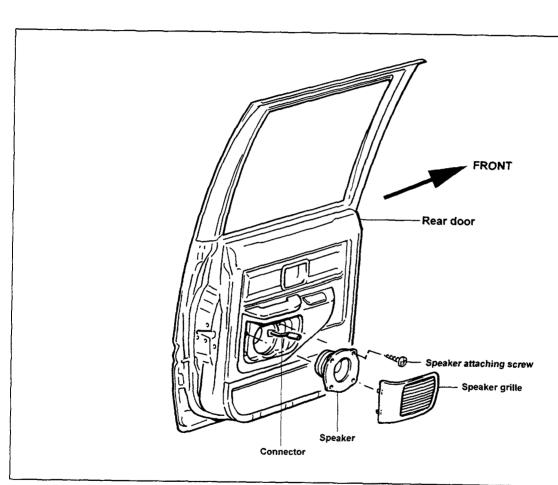
To install, follow the removal steps in the reverse order, pushing the grille in carefully untill it locks.

# REAR SPEAKER





# →+ REMOVAL AND INSTALLATION



#### **Removal Steps**

- 1. Speaker Grille
  - Pull the grille to release the clips.

#### 2. Speaker

- Remove four screws.
- Disconnect the connector.

# **Installation Steps**

To install, follow the removal steps in the reverse order, pushing the grille in carefully untill it locks.

#### Note:

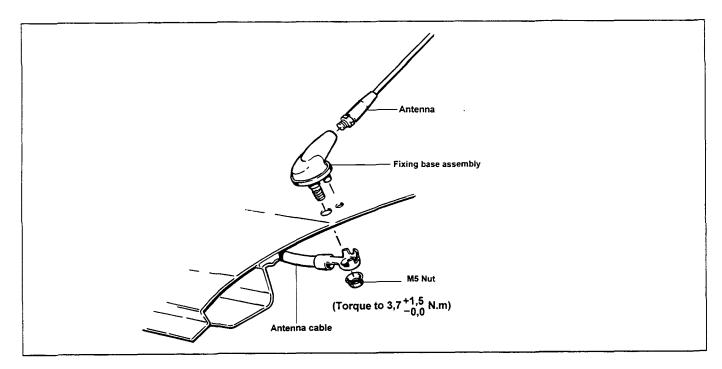
Connector should point towards the front of vehicle

# **ANTENNA**





# →← REMOVAL AND INSTALLATION



#### **DOUBLE CAB MODELS**

# **Removal Steps**

#### 1. Roof headliner

· Remove:

Sun visors.

Sun visor support clips.

Map reading lamp.

Roof mounted assist grips and plugs.

Interior light.

· Remove headliner from vehicle - refer section (10-39).

#### 2. Antenna

- Remove M5 nut assembly (8mm socket).
- · Remove antenna and base assembly.
- · Antenna can be unscrewed from base.

#### **Installation Steps**

· Reverse above procedure, making sure that locator on antenna gasket is correctly installed into hole in roof and that cable is correctly intalled before entering nut. Torque nut to  $3.7^{+1.5}_{-0.0}$  N.m.

#### DOUBLE CAB MODELS .



#### Removal Steps

#### 1. Roof headliner

Remove:

Sun visors.

Sun visor support clips.

Map reading lamp.

Front roof mounted assist grips and plugs.

Front door lace from pinch weld.

 Pull headliner front down sufficiently to allow access to antenna mounting nut.

#### 2. Antenna

- Remove M5 nut assembly (8mm socket).
- Remove antenna and base assembly.
- Antenna can be unscrewed from base.



#### **Installation Steps**

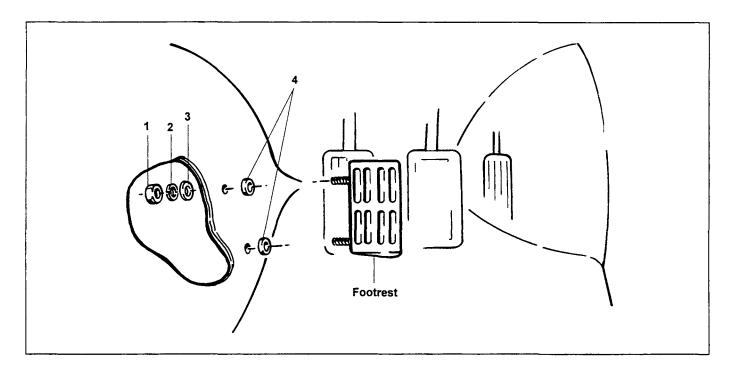
 Reverse above procedure, making sure that locator on antenna gasket is correctly installed into hole in roof and that cable is correctly intalled before entering nut. Torque nut to 3,7 <sup>+1,5</sup><sub>-0.0</sub>Nm.

## **DRIVER'S FOOTREST**





# |→◆ | REMOVAL AND INSTALLATION



#### **Removal Steps**

- 1. Remove 2 nuts and washers (1, 2, 3) from underneath vehicle.
- 2. Remove footrest and 2 spacers (4) from inside vehicle.

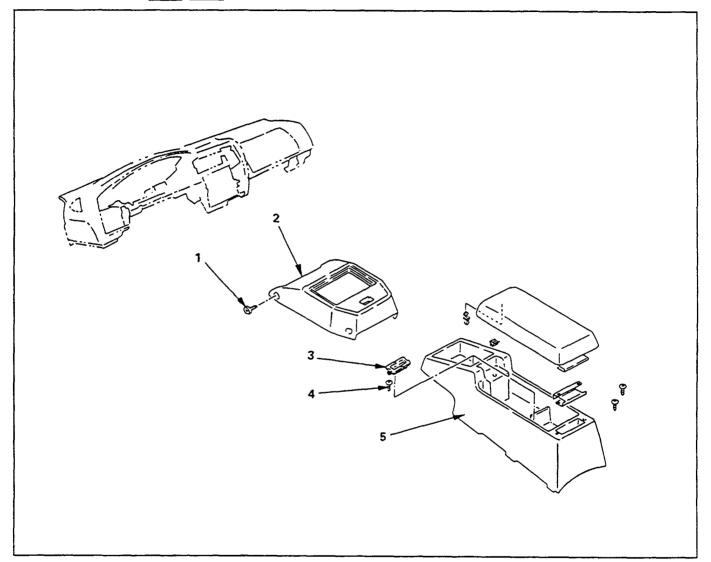
- 1. Place 2 spacers (4) over footrest studs.
- 2. Enter footrest studs into hole in floor through carpet. (from inside of vehicle).
- 3. From underneath of vehicle, enter washers and nuts onto studs.
- 4. Tighten nuts.

### **CONSOLE BOX**





## **REMOVAL AND INSTALLATION**



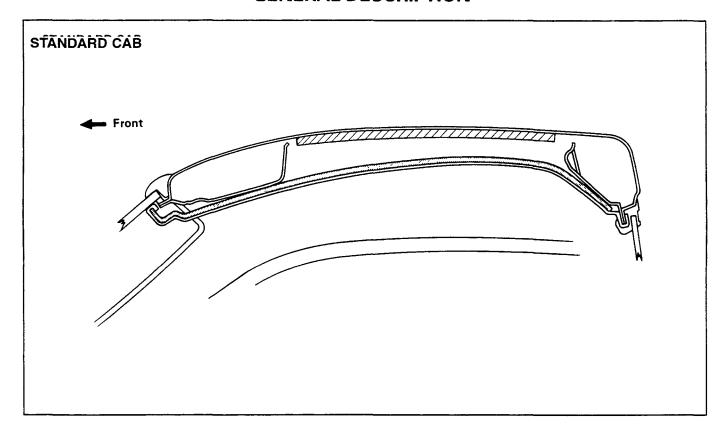
#### **Removal Steps**

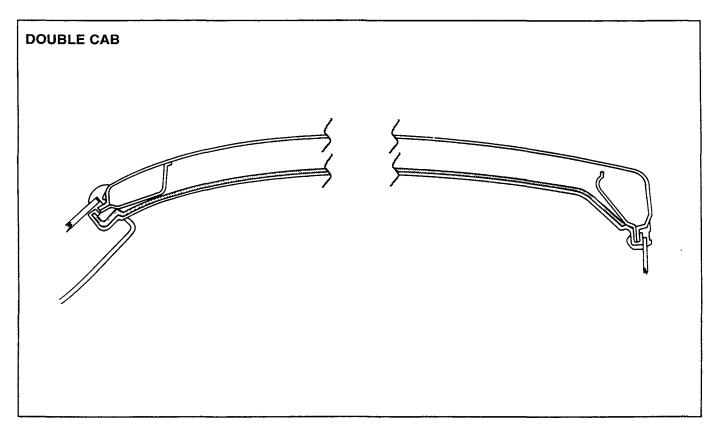
- 1. Screw
- 2. Center console
- 3. Hole cover
- 4. Screw
- 5. Rear console

- 5. Rear console
- 4. Screw
- 3. Hole cover
- 2. Center console
- 1. Screw

## **HEADLINING**

## **GENERAL DESCRIPTION**

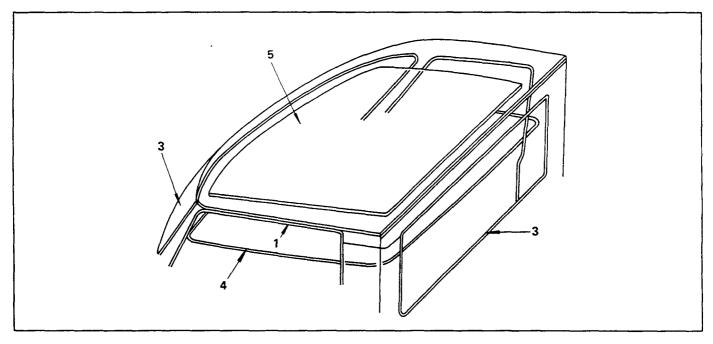




# **++**



### **REMOVAL AND INSTALLATION**



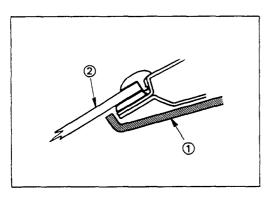
#### **Removal Steps**

- 1. Door finisher
- 2. Sun visor and dome lamp assembly
- 3. Windshield and back light glass
- 4. Head lining
- 5. Insulation pad

Note: Item 5 not required for double cab.

#### **Installation Steps**

- 5. Insulation pad
- ▲ 4. Headlining
  - 3. Windshield and back light glass
  - 2. Rear view mirror, sunvisor and dome lamp assembly
  - 1. Door finisher

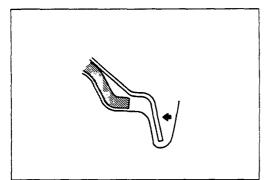




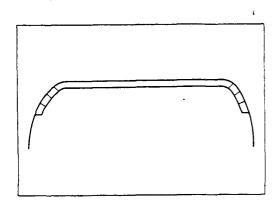
#### Important Operations — Installation

#### 4. Head Lining

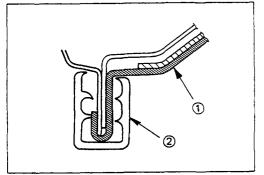
- 1) Install the headlining ① to the body panel.
  - 2: Windshield glass



2) Roll up the headlining in the body side of the back light glass and door opening.



3) Roll up the headlining provided with slits, in the corner.

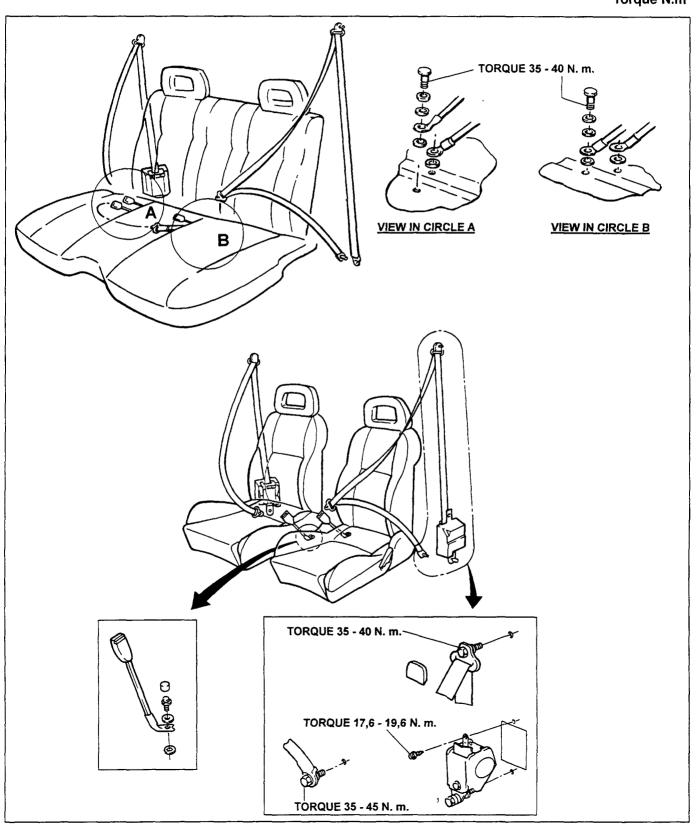


- 4) Roll up the headlining ① in the body side of door opening.
- 5) Fix to the door side, using the finisher 2.

## **FRONT SEAT**

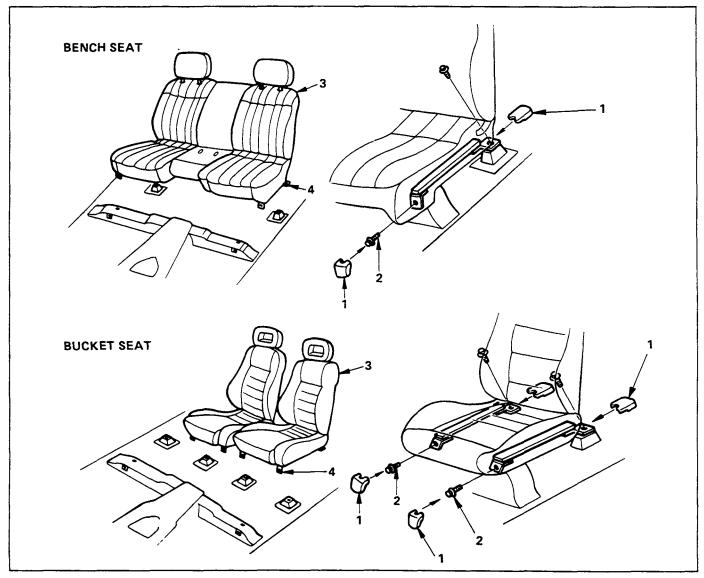
### SPECIAL PARTS FIXING BOLT

Torque N.m





### **REMOVAL AND INSTALLATION**



#### Removal Steps

- 1. Adjuster cover
- 2. Bolt
- 3. Seat assembly
- 4. Adjuster

### **Installation Steps**

- 4. Adjuster
- 3. Seat assembly
- ▲ 2. Bolt
  - 1. Adjuster cover



#### Important Operation — Installation

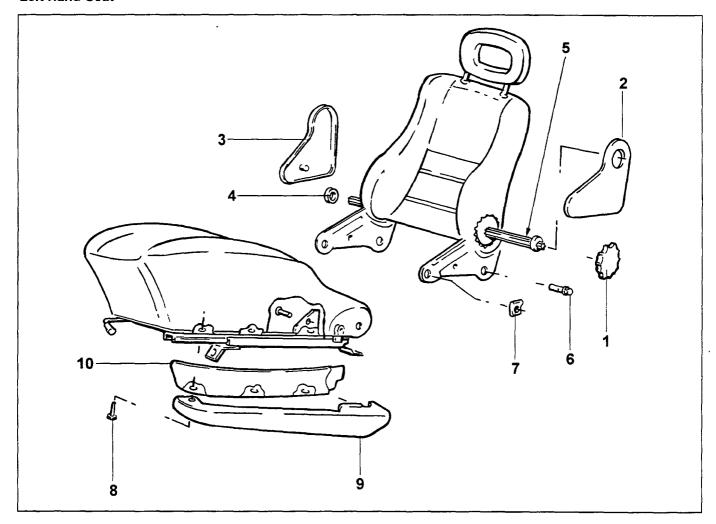


2. Bolt Bolt Torque

35,0 - 45,0 N.m

## FRONT SEAT ASSEMBLY

#### **Left Hand Seat**



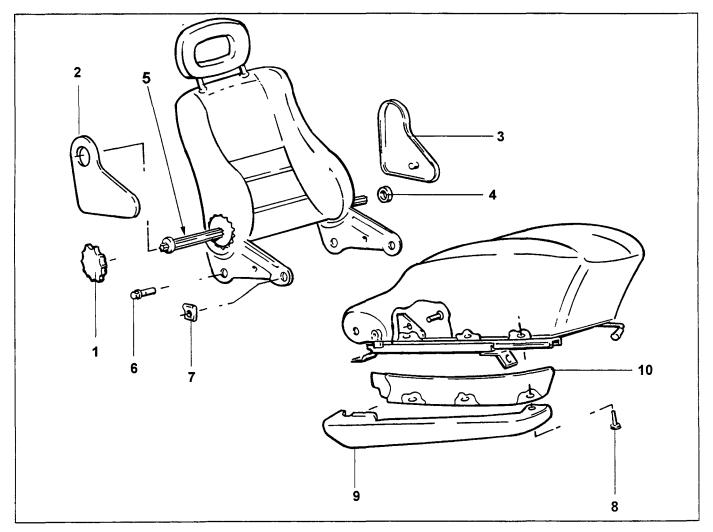
#### **Removal Steps**

- 1. Adjuster wheel, seat back
- 2. Cover, adjuster (outer)
- 3. Cover, adjuster (inner)
- 4. Plug
- 5. Connector rod assembly
- 6. Screw
- 7. Locking washer
- 8. Oval head screw
- 9. Seat slide cover
- 10. Front seat cover

- 10. Front seat cover
- 9. Seat slide cover
- 8. Oval head screw
- 7. Locking washer
- 6. Screw
- 5. Connector rod assembly
- 4. Plug
- 3. Cover, adjuster (inner)
- 2. Cover, adjuster (outer)
- 1. Adjuster wheel, seat back

## FRONT SEAT ASSEMBLY

#### **Right Hand Seat**



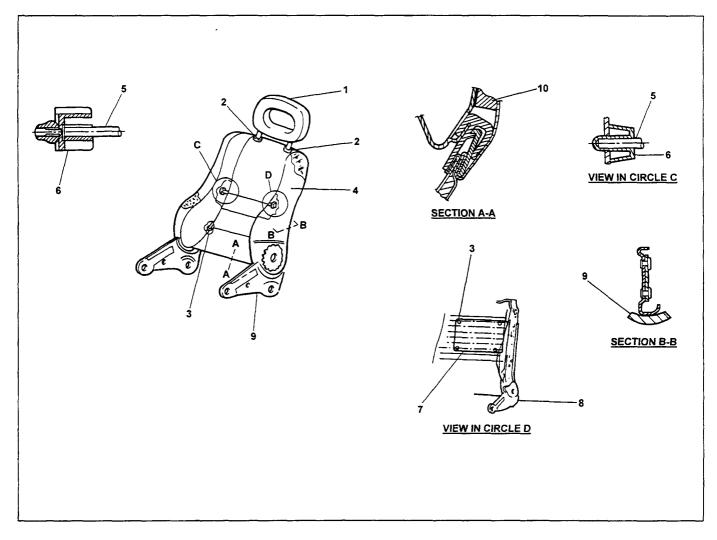
#### **Removal Steps**

- 1. Adjuster wheel, seat back
- 2. Cover, adjuster (outer)
- 3. Cover, adjuster (inner)
- 4. Plug
- 5. Connector rod assembly
- 6. Screw
- 7. Locking washer
- 8. Oval head screw
- 9. Seat slide cover
- 10. Front seat cover

- 10. Front seat cover
- 9. Seat slide cover
- 8. Oval head screw
- 7. Locking washer
- 6. Screw
- 5. Connector rod assembly
- 4. Plug
- 3. Cover, adjuster (inner)
- 2. Cover, adjuster (outer)
- 1. Adjuster wheel, seat back

### FRONT SEAT BACK REST

#### **Left Hand Seat**



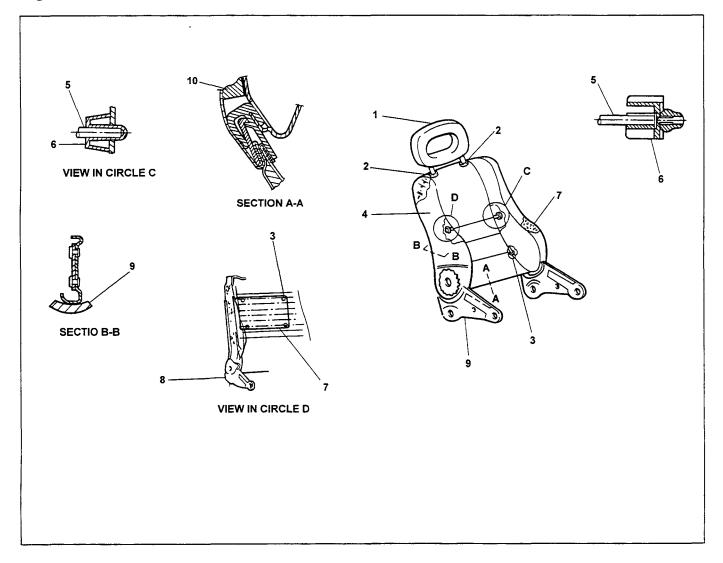
### **Removal Steps**

- 1. Head rest assembly
- 2. Head rest sleeve assembly
- 3. Hog ring
- Cover assembly, front seat back rest
- 5. Suspension wire
- 6. Bushing
- 7. Insulation, seat back spring
- 8. Seat back assembly
- 9. Insulating strip
- 10. Insulating strip

- 10. Insulating strip
- 9. Insulating strip
- 8. Seat back assembly
- 7. Insulation, seat back spring
- 6. Bushing
- 5. Suspension wire
- Cover assembly, front seat back rest
- 3. Hog ring
- 2. Head rest sleeve assembly
- 1. Head rest assembly

### FRONT SEAT BACK REST

#### **Right Hand Seat**



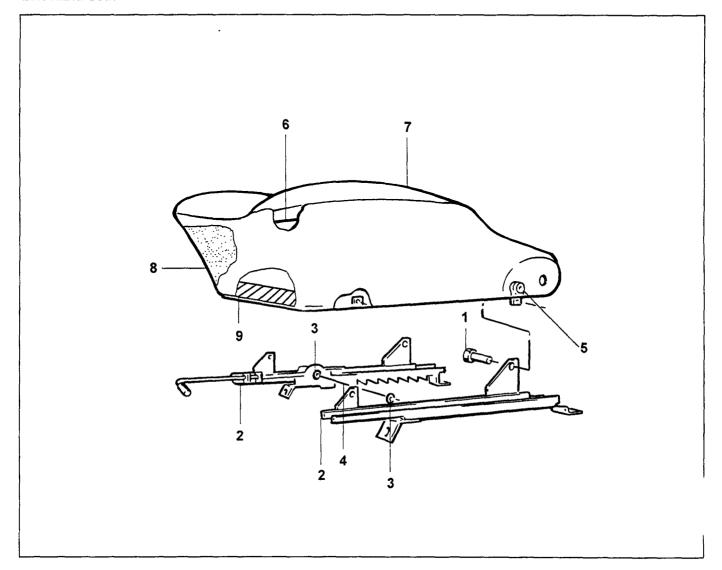
#### **Removal Steps**

- 1. Head rest assembly
- 2. Head rest sleeve assembly
- 3. Hog ring
- Cover assembly, front seat back rest
- 5. Suspension wire
- 6. Bushing
- 7. Insulation, seat back spring
- 8. Seat back assembly
- 9. Insulating strip
- 10. Insulating strip

- 10. Insulating strip
- 9. Insulating strip
- 8. Seat back assembly
- 7. Insulation, seat back spring
- 6. Bushing
- 5. Suspension wire
- Cover assembly, front seat back rest
- 3. Hog ring
- 2. Head rest sleeve assembly
- Head rest assembly

### FRONT SEAT CUSHION

#### **Left Hand Seat**



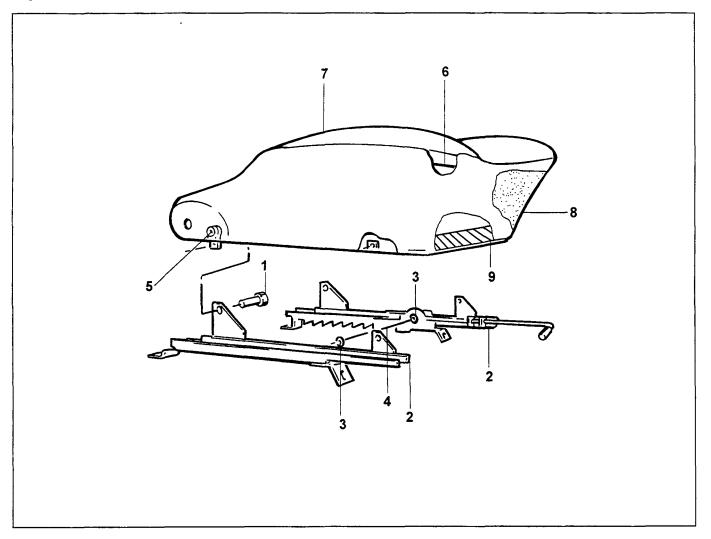
#### **Removal Steps**

- 1. Screw
- 2. Seat slide assemblies, inner and outer
- 3. Washer
- 4. Control cable
- 5. Screw
- 6. Hog ring
- 7. Cover assembly, seat cushion
- 8. Pad assembly
- 9. Front seat assembly

- 9. Front seat assembly
- 8. Pad assembly
- 7. Cover assembly, seat cushion
- 6. Hog ring
- 5. Screw
- 4. Control cable
- 3. Washer
- Seat slide assemblies, inner and outer
- 1. Screw

## FRONT SEAT CUSHION

#### **Right Hand Seat**



### **Removal Steps**

- 1. Screw
- Seat slide assemblies, inner and outer
- 3. Washer
- 4. Control cable
- 5. Screw
- 6. Hog ring
- 7. Cover assembly, seat cushion
- 8. Pad assembly
- 9. Front seat assembly

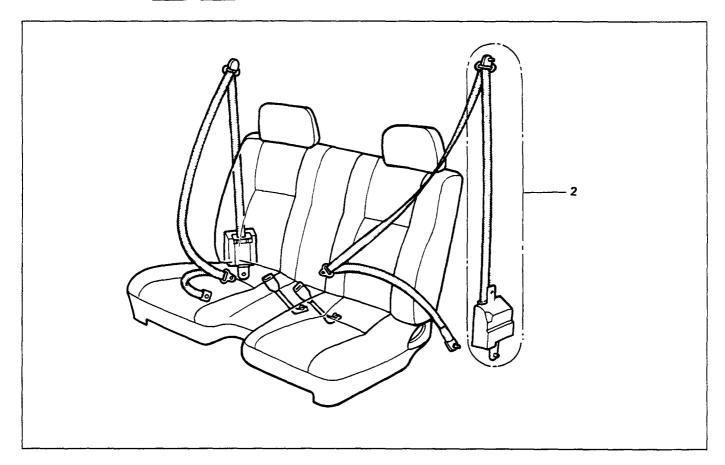
- 9. Front seat assembly
- 8. Pad assembly
- 7. Cover assembly, seat cushion
- 6. Hog ring
- 5. Screw
- 4. Control cable
- 3. Washer
- Seat slide assemblies, inner and outer
- Screw

## FRONT AND REAR SEAT BELT





## **REMOVAL AND INSTALLATION**

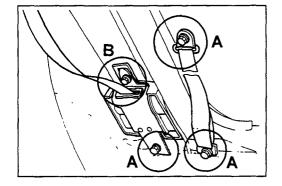


### **Removal Steps**

- 1. Trim
- 2. Seat belt and retractor

## **Installation Steps**

- 2. Seat belt and retractor
  - 1. Trim





### Important Operation - Installation



Bolt Torque - N.m

 A- 35,0 - 45,0	
 B- 17.6 - 19.6	

,

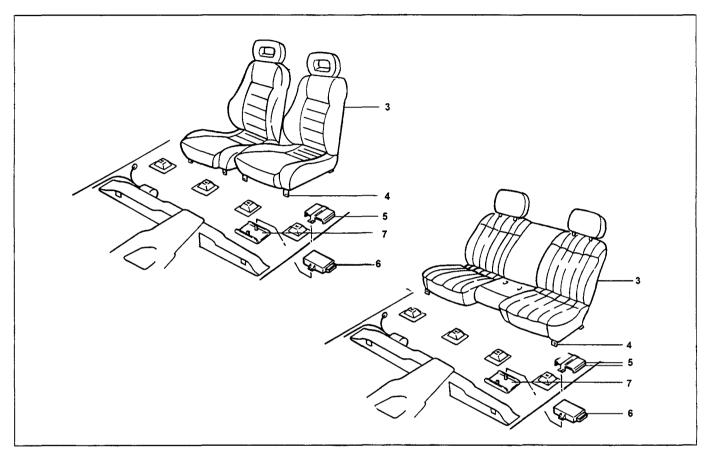
2. Seat Belt and Retractor

## **VEHICLE SECURITY SYSTEM**





### **REMOVAL AND INSTALLATION**



#### **Removal Steps**

- 1. Adjuster cover
- 2. Bolt
- 3. Seat assembly
- 4. Adjuster
- 5. Upper bracket
- 6. VSS Control box
- 7. Lower bracket
- 8. Diff lock housing

#### **Installation Steps**

- 7. Lower bracket
- 6. VSS Control box
- 5. Upper bracket
- 4. Adjuster
- 3. Seat assembly
- ▲ 2. Bolt
  - 1. Adjuster cover



## Important Operation – Installation



2. Bolt

Bolt Torque - Nm

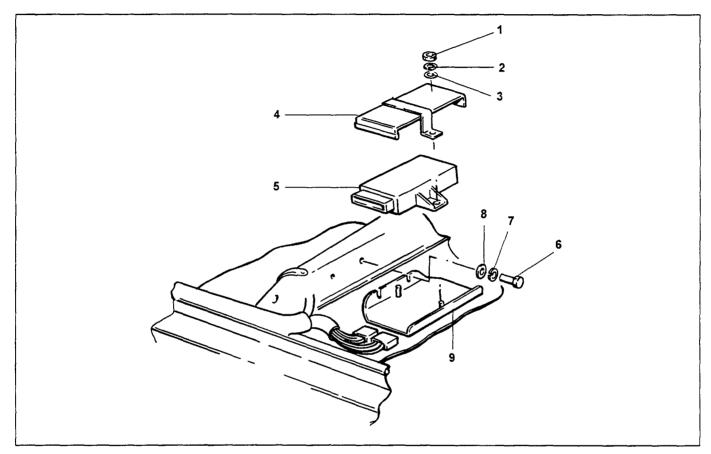
35,0 - 45,0 Nm

## **VSS CONTROL**





### **REMOVAL AND INSTALLATION**



#### **Removal Steps**

- 1. Nut
- 2. Spring washer
- 3. Flat washer
- 4. Vehicle security system upper bracket
- 5. Vehicle security system control box
- 6. Bolt
- 7. Spring washer
- 8. Flat washer
- Vehicle security system lower bracket

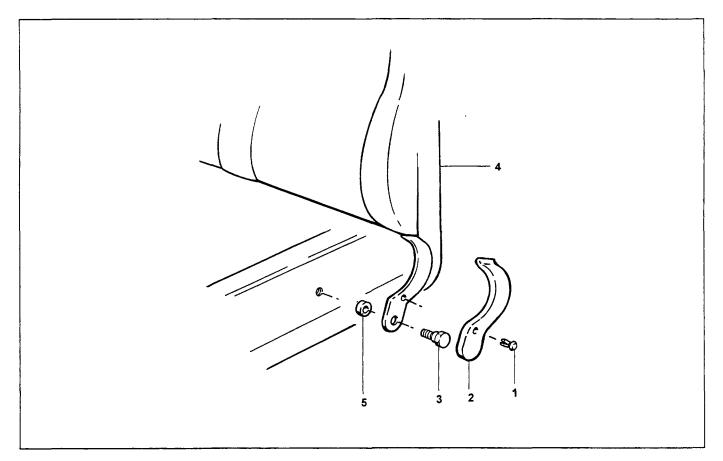
- 9. Vehicle security system lower bracket
- 8. Flat washer
- 7. Spring washer
- 6. Bolt
- 5. Vehicle security system control box
- 4. Vehicle security system upper bracket
- 3. Flat washer
- 2. Spring washer
- 1. Nut

## **REAR SEAT BACKREST**





## **REMOVAL AND INSTALLATION**

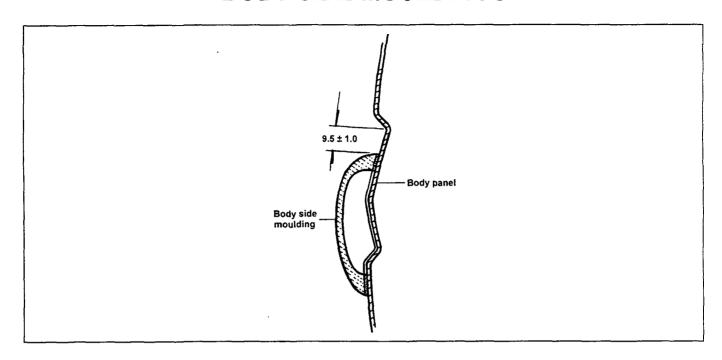


#### **Removal Steps**

- 1. Expansion-rivet
- 2. Cover-hinge
- 3. Bolt-shoulder
- 4. Rear seat back rest assembly
- 5. Washer-flat 5 mm

- 5. Washer-flat 5 mm
- 4. Rear seat back rest assembly
- 3. Bolt-shoulder
- 2. Cover-hinge
- 1. Expansion-rivet

### **BODY SIDE MOULDINGS**



#### **Removal Steps**

- Body side mouldings are fixed to the body by means of adhesive tape, and need to be peeled off the body carefully so as not to damage the moulding - the adhesive tape will however be damaged.
- Remove remaining adhesive tape from body.

#### **Installation Steps**

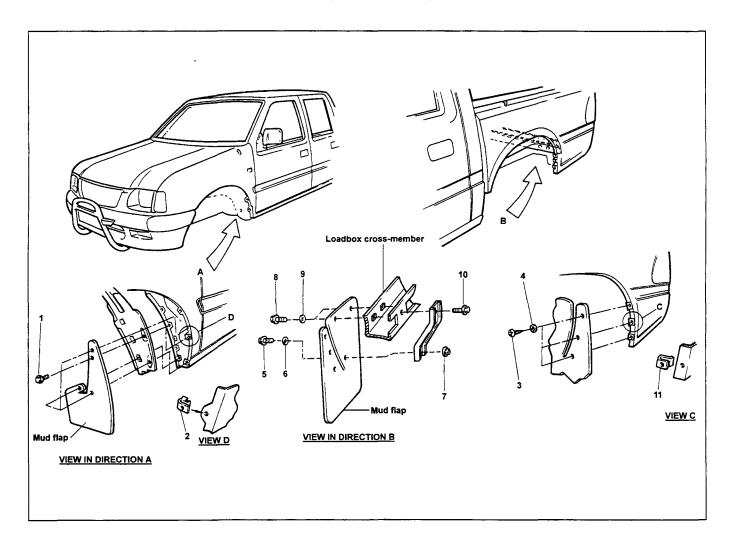
Removed mouldings can be re-used:

- 1. Remove remaining adhesive tape from moulding.
- 2. Clean moulding with benzine.
- Apply new double sided adhesive tape (max thickness 1,0mm)
- 4. Clean body side of vehicle with benzine.
- Locate moulding on body side and mark position in a few places with masking tape.
- 6. Remove adhesive tape backing.
- 7. Carefully place moulding onto body next to tape markers.
- 8. Apply pressure to fix into place.

Note: If brand new mouldings are to be fitted, work from step 4 above.

9. Ensure good alignment of one moulding to another. (And to wheelarch mouldings).

## **MUDFLAPS**



### **Removal Steps**

#### 1. Front Mudflaps

- 1.1 Remove 4 screws (1)
- 1.2 Remove mudflap

#### 2. Rear Mudflaps

- 2.1 Remove 3 tapping screws & washers (3) (4)
- 2.2 Remove 1 bolt, washer & nut (5) (6) (7)
- 2.3 Remove 2 bolts & washers (8) (9)
- 2.4 Remove mudflap

#### **Installation Steps**

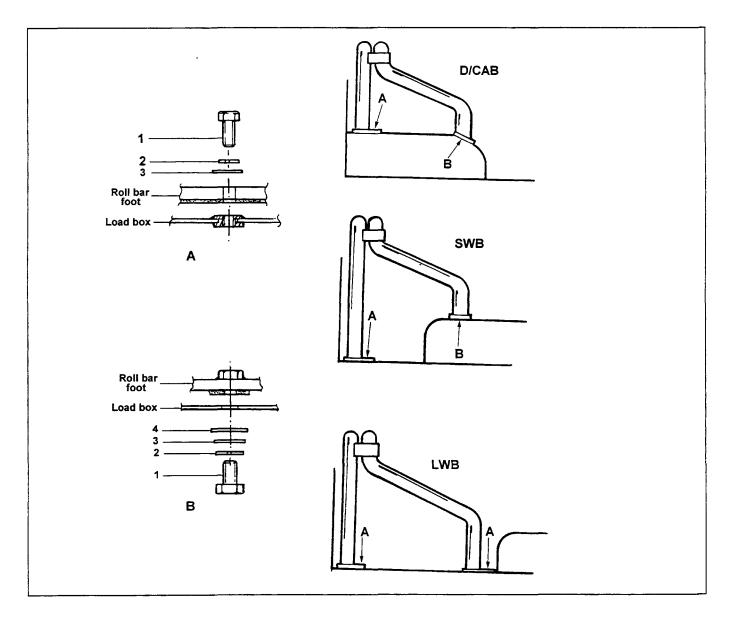
#### 1. Front Mudflaps

- 1.1 Ensure 4 spire nuts (2) are correctly located.
- 1.2 Hold mudflap in position.
- 1.3 Enter inside screw (1) first, then enter outside screws (1).
- 1.4 Thighten inside screw and lower outer screw (1).
- 1.5 Ensure mudflap matches wheelarch shape before tightening upper screws (1).

#### 2. Rear Mudflaps

- 2.1 Loosen upper bolt (10) on mudflap support.
- 2.2 Check that 3 clipnuts (11) are correctly located.
- 2.3 Hold mudflap in position and enter 2 upper bolts and washers (8, 9).
- 2.4 Enter 3 tappings screws and washers2.5 Enter lower bolt, washer and nut (5, 6,
  - 7).
- 2.6 Ensure mudflap correctly aligned, then tighten two upper bolts (8) and lower bolt/nut (5,7).
- 2.7 Tighten tappings screws (3).
- 2.8 Finally tighten upper support bolt (10).

### **ROLLBAR**

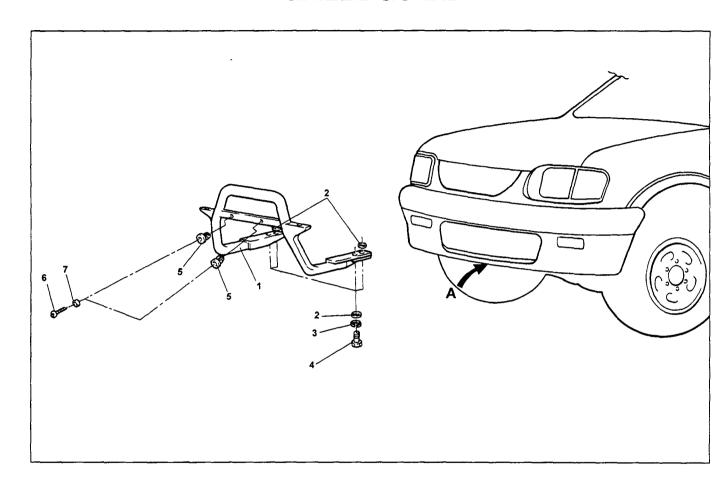


#### **Removal Steps**

- 1. Remove 4 mounting bolts and washers (1) (2) (3) (4)
- 2. Lift rollbar out of loadbox.

- 1. Position rollbar into loadbox.
- 2. Line up holes in rollbar with holes in loadbox.
- Enter four bolts/washers (1) (2)
   (3) (4) refer sketch for particular mounting method to suit either double cab, single cab, short wheel base or single cab long wheel base.
- 4. Before finally tightening the bolts, ensure that rollbar is equally spaced in loadbox.
- 5. Torque mounting bolts to 30 N.m +/- 5,0

## **GRILLE GUARD**



### **Removal Steps**

- 1. Unplug driving lights from harness (refer section 9)
- 2. Remove four bolts & washers (4) (3) (2)
- Note extra washers on rear bolt
   (5) between grille guard and frame.
- 4. Remove grille guard.

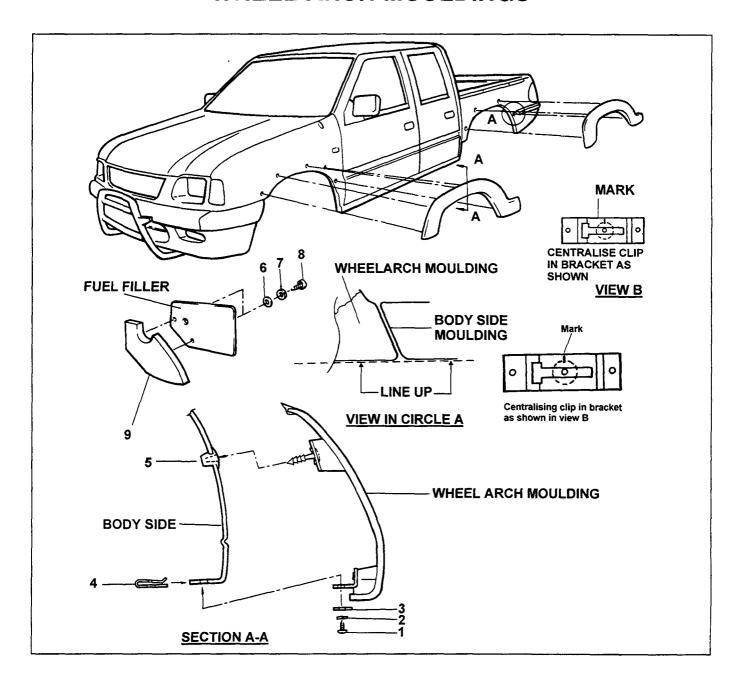
#### Installation Steps

- 1. Hold grille guard in place.
- Enter front bolts/washers do not tighten.
- Slide washers (5) between grille guard mounting and frame.
- 4. Enter rear bolts/washers.
- Centralise grille guard on vehicle and tighten the four bolts (torque 25,0 - 34,0)

Note: Additional washers may be fitted between grille guard mounting and frame at the front bolts to align grille guard horizontally with bumper/grille.

Re-connect driving lights to harness (refer section 9).

### WHEEL-ARCH MOULDINGS

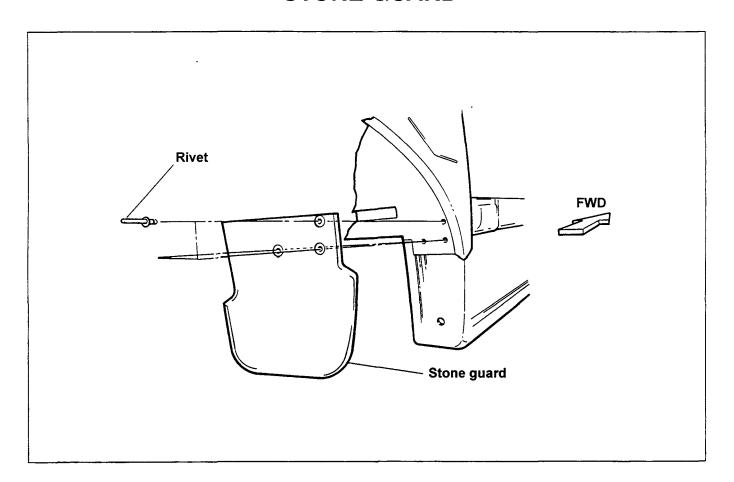


#### **Removal Steps**

- Remove 3 screws/washers (1)
   (2) (3) underneath moulding.
- Carefully pull off the moulding from the body - this must be done evenly to preent body damage.
- 3. Remove 2 screws/washers (6) (7) (8) and remove fuel flap moulding (9).

- 1. Ensure that clip is centralised in bracket as shown at arrow B.
- 2. Align clip with ferrule (5), and push moulding into place.
- Enter screws/washers (1) (2) (3) into clipnut (4) and tighten, ensuring correct alginment with body side moulding.
- 4. Fit fuel flap moulding using 2 screws / washers (6) (7) (8).

## **STONE GUARD**



#### **Removal Steps**

- 1. Drill out rivets.
- 2. Remove stone guard.

### **Installation Steps**

 Rivet the stone guard in place using suitable rivets.
 Recommended rivet has shank 4,8, 19,6 long, and a head 16,0.